Government of
Saskatchewan

Annual Report
1985 - 86

Saskatchewan
Energy and Mines

for the fiscal year ending
March 31, 1986

Table of Contents

Letters of Transmittal ____ 3
Deputy Minister's Introduction ____ 4
Organization Chart ____ 6
Finance and Administration Division ____ 7
Resource Policy and Economics Division ____ 11
Geology and Mines Division ____ 17
Petroleum and Natural Gas Division ____ 29

List of Figures

1. Location of Major Mineral Deposits, Saskatchewan ____ 18
2. Precambrian Bedrock Geology Maps, 1:250,000 scale ____ 21
3. Precambrian Geology Field Projects ____ 22
4. Distribution of Inquiries ____ 24
5. New Areas Acquired Under Claims, Claim Blocks and Permits ____ 27
6. 1985-86 Assessment Work Expenditure Distribution by Region (1984-85 Comparative Distribution) ____ 28
7. Wells Drilled by Area ____ 31
8. Total Metres Drilled by Area ____ 31
9. Remaining Oil Reserves ____ 32
10. Remaining Gas Reserves ____ 32
11. Crude Oil Production ____ 33
12. Quality of Saskatchewan Crude Oil Production by Area for Calendar Year 1985 ____ 33
13. Natural Gas Production ____ 33
14. Average Crude Oil Prices ____ 34
15. Revenue From the Sales of Crown Petroleum and Natural Gas Rights ____ 35
16. Conventional Crude Oil Royalty Curves for New Developments March, 1986 ____ 37

Letters of Transmittal

The Honourable Frederick William Johnson
Lieutenant-Governor
Province of Saskatchewan

Dear Sir:

I have the honour to submit herewith the Annual Report of Saskatchewan Energy and Mines for the fiscal year ending March 31, 1986.

Respectfully Submitted,

Honourable Lorne H. Hepworth,
Minister of Energy and Mines

The Honourable Lorne H. Hepworth
Minister of Energy and Mines
Province of Saskatchewan

Dear Sir:

I have the honour to submit, for your consideration the Annual Report of Saskatchewan Energy and Mines for the fiscal year ending March 31, 1986.

Respectfully Submitted,

Bob Reid

Bob Reid
Deputy Minister
Saskatchewan Energy and Mines

Deputy Minister's Introduction

Saskatchewan Energy and Mines was again successful in facilitating the discovery, development and utilization of the provinces's mineral resources, which is the department's primary objective.

This success is due in large part to the hard work of department personnel. Industry activity and the requirements of the government to amend existing and implement new policies placed heavy demands on the staff during the year. I extend my thanks to all staff members for having met these demands with great skill and professionalism.

The provincial oil industry began the fiscal year positively with the signing of the Western Accord in March, 1985. Under terms of the agreement, the Governments of Canada, Saskatchewan, Alberta and British Columbia made new developments exempt from the Petroleum and Gas Revenue Tax, (PGRT) but left them eligible for grants through the Petroleum Incentive Program, (PIP) until March 31, 1986.

In June, 1985 Saskatchewan extended its oil royalty/tax incentive program until the end of 1986.

In the latter part of the fiscal year Saskatchewan and the other producing provinces in western Canada witnessed a dramatic drop in world crude oil prices which fell by 60 per cent in a three month period. Given the timing of the price collapse, key indicators were just beginning to measure significant negative impacts on the provincial oil industry as the fiscal year ended. By the end of this reporting period, the province, in consultation with the oil industry, was developing a temporary program to help maintain oilfield employment during this interval of unstable prices.

Over $1 billion was spent by oil and gas companies on exploration and development in the province during the year. Much of this was invested in drilling new wells. Drilling activity remained high in 1985 with 3,848 wells drilled compared to 2,970 in 1984. Oil production increased by 7.2 per cent in 1985 over the previous year. Remaining reserves estimates rose also as a result of the focus on exploration and development.

Land sales revenue in 1985-86 totalled $122.8 million compared to $126.8 in 1984-85. The first three sales of the fiscal year earned $114.5 million. Declining world crude oil prices led to industry uncertainty and reduced the number of postings for the March, 1986 sale which brought in $8.3 million, a considerably lower amount than other recent sales.

A new, natural gas policy was announced by the province in July, 1985. The policy was designed to help Saskatchewan achieve its goal of self-sufficiency in natural gas production by the early 1990's. Export sales of natural gas and direct sales to new industrial projects, such as the Co-op Upgrader which use gas as a feedstock, are permitted under the policy. As well, the policy restructures the regulated pricing system for gas produced from new gas wells.

In January, 1986 Saskatchewan's first export sale of natural gas was made by Ocelot Industries Ltd. to industrial users in Ontario. Under conditions of the policy, Ocelot Industries committed to find approximately three times as much gas as it will sell to ensure an expansion of the provincial reserves base. Although producer revenues were increased as a result of the natural gas policy, there was no impact on consumer rates in Saskatchewan.

Further changes were made to Saskatchewan's natural gas industry when the Governments of Canada, Saskatchewan, Alberta and British Columbia signed the Agreement to Deregulate Interprovincial Gas Markets on October 31, 1985. The governments involved agreed to sell gas interprovincially at freely negotiated prices and to improve access to U.S. markets for western producers. Saskatchewan Power Corporation (SPC), is saving $600,000 under the agreement's transportation assistance program which expires November 1, 1986.

Natural gas drilling activity remained strong in 1985 with 437 wells drilled compared to 444 in 1984. The value of land sales in gas prone areas continued to grow to $21.4 million, almost double the amount received in any previous year.

Saskatchewan's long term objective to develop its heavy oil resource was achieved in part with the confirmation of a 50,000 barrel per day heavy oil upgrader. In September, 1985 the Governments of Canada and Saskatchewan, and Federated Co-operatives Limited announced that the upgrader would be built at the site of the Co-op Refinery in Regina. Construction on the $650 million project began during the year. Completion and start-up is scheduled for 1988. Engineering and construction are creating 2,980 person years of employment.

Engineering studies related to a second upgrader proposed for the Lloydminster area were carried out during the year. The federal government and provincial governments of Saskatchewan and Alberta together with Husky Oil are jointly supporting the $90 million study program which will be finished in March, 1987. Saskatchewan's share of the cost is $13.5 million.

The environmental impact of heavy oil development has been carefully examined by the government during the past several years. In 1985-86 the Heavy Oil Project published a number of studies to help form guidelines for development. The studies, performed through consultation with industry, will be used as the framework for future policy and regulatory initiatives.

Important research in heavy oil development continued under the Heavy Oil/Fossil Fuels Research Program. As of March 31, 1986, $26.3 million was available for research projects over a two year period.

During the year the Heavy Oil/Fossil Fuels Research Program provided funding to help set up the Petroleum Division of the Saskatchewan Research Council, (SRC). The former Research and Development Division of Saskoil was transferred and incorporated as the new SRC division. With its

broader financial support base and technical research, the Petroleum Division can benefit all provincial companies active in the development of these resources.

Another successful project funded under the Heavy Oil/Fossil Fuels Research Program was a novel waterflood pilot in the Viking Sand reservoirs near Dodsland. As a result of this research, several companies invested $12 million in a commercial-scale project based on the pilot.

The Potash Resource Payment Agreements, (PRPA), which were extended last year until December 31, 1986, included incentives for the industry to spend money on market development and for some types of research. During the year, the department has been working with industry to review these agreements, and a revised royalty/tax system is expected to be in place by the end of 1986.

Shifting potash markets in recent years caused the department to concentrate on market analysis and development. Market development was particularly successful in Asia. The China Potash Agronomic Program, a joint undertaking by the Saskatchewan government, the potash industry and the Canadian International Development Agency, was expanded from two to seven Chinese provinces.

In March, 1986 an agreement between Saskatchewan and the international Potash and Phosphate Institute brought an important research organization to the province. The Potash and Phosphate Institute of Canada moved its headquarters from Toronto to Saskatoon where its work in research, demonstration and education will help support the sale of Saskatchewan potash in offshore markets.

A federal-provincial conference in Ottawa was organized by Saskatchewan Energy and Mines to increase awareness among federal government and trade officials of the economic importance and export potential of potash.

Saskatchewan remains the leading uranium producer in the western world. The value of sales in 1985 was $459 million, a 30 per cent increase over 1984. During the year feasibility studies began at Cigar Lake, the world's richest uranium deposit. The Cigar Lake mine is expected to go into production by the 1990's.

The government consulted with industry during the year to review and modify uranium royalties. An amended royalty system should be operational by the end of 1986.

Initiatives to encourage Saskatchewan's base and precious metals development were introduced in the Mineral Industry Recovery Program of 1984. The program allows producers to recover most of their capital costs before being subject to royalty payments. As well, industry is the beneficiary of an increased geoscientific data base. In March, 1986 an additional $100,000 was provided for geoscientific research.

A high level of industry activity continued in 1985 with expenditures of $10.9 million compared to $10.2 million in 1984. Most of these expenditures were for gold exploration in the La Ronge belt, an area of great interest to the gold exploration and mining community. The first gold mine in this region at Star Lake is scheduled to go into production in late 1986. Feasibility studies are being carried out on several other properties in the La Ronge vicinity.

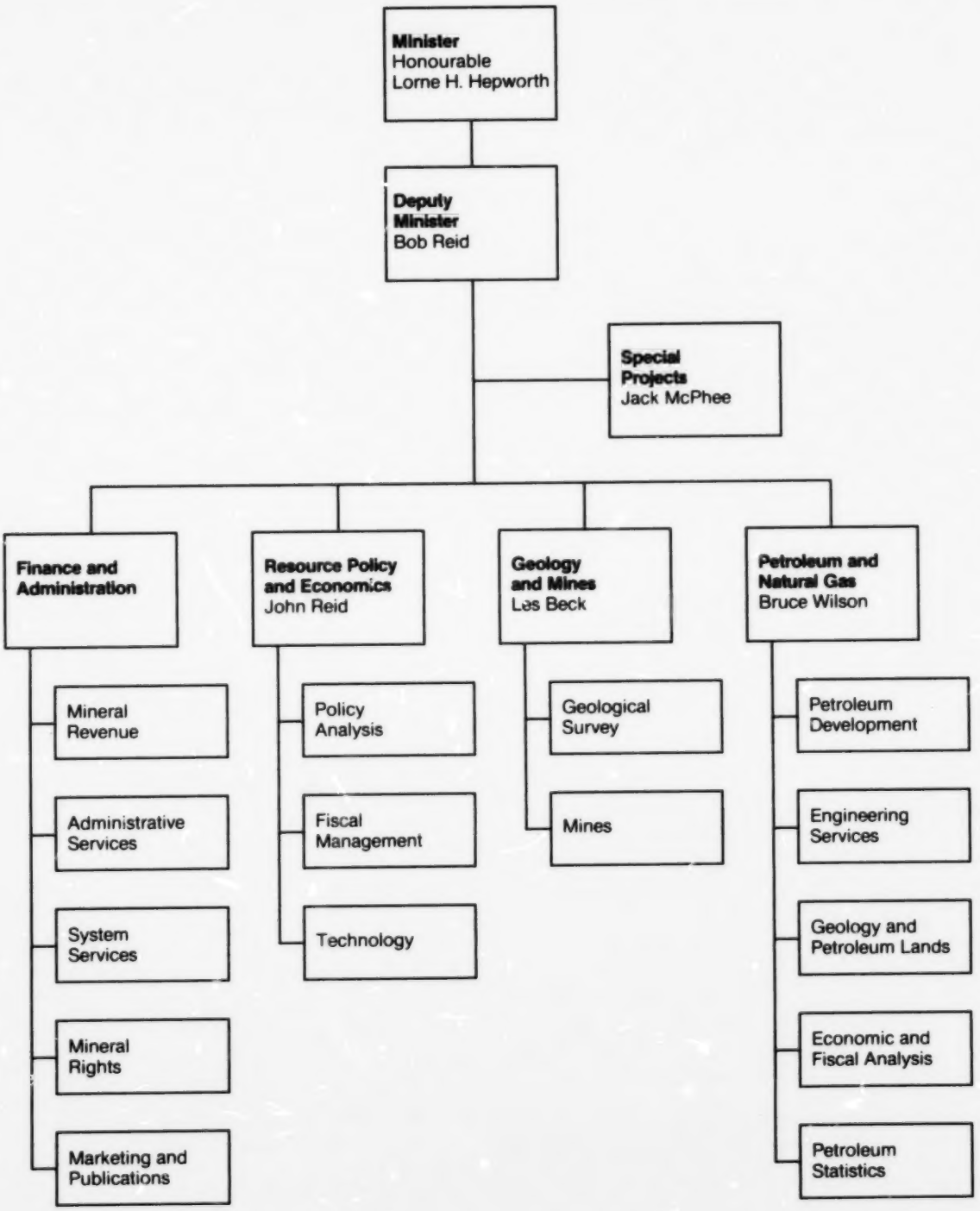
The department contributed to the government's legislative reform with two new acts introduced in July, 1985. The Mineral Resources Act, 1985 and The Crown Minerals Act replaced outdated legislation and streamlined legislative and regulatory structures related to energy and minerals.

Respectfully Submitted,

Bob Reid

Bob Reid

Organization Chart



Finance and Administration Division

The Finance and Administration Division is responsible for mineral revenue collection and audits, internal administration and personnel, legislative co-ordination, communication, mineral rights, system services, marketing and publications.

The Finance and Administration Division is now composed of five branches:

- Mineral Revenue
- Administrative Services
- Mineral Rights
- System Services
- Marketing and Publications

Mineral Revenue Branch

The Mineral Revenue Branch is responsible for collecting, recording and accounting for the various resource revenues owing to the province. The branch:

- ensures that revenues and accompanying returns and reports are received when due;
- assesses certain kinds of resource revenues on an annual or periodic basis;
- assesses interest and/or penalties on late payments and overdue returns;
- processes revenues through computer and manual systems, as input to financial and management information reports;
- audits resource companies to ensure compliance with taxation legislation;
- maintains historical records of all resource revenues received by the department;
- prepares special reports for use by department officials;
- informs the resource industry of its responsibilities under existing legislation and changes thereto; and
- maintains close liaison with other branches of the department on revenue matters.

This branch is divided into two sections; revenue processing and revenue monitoring. Revenue processing is responsible for maintenance of the taxroll; receiving and recording of revenue; verification and processing of revenue returns; billing of various royalties, rentals and taxes; taxpayer information and assistance relating to resource taxation legislation, requirements and procedures; maintenance of computer systems and their interface with other department and government systems; and processing and payment of incentive grants, compensation payments and payments to holders of trust certificates.

Revenue monitoring is responsible for office and field audits in all resource revenue areas, follow up of delinquent returns, collection of accounts receivable and informing taxpayers of resource taxation legislation.

The main objectives of the branch are to ensure that resource revenues owing to the province are received when due, that the amounts paid are correct and properly accounted for, and that data is available on a regular and accurate basis for preparation of financial reports. To attain these objectives, the branch is committed to a continuous program of review and improvement to existing systems and procedures, or to the development of new systems.

Other objectives include continued and improved communication with taxpayers and the resource industry, greater involvement in policy decisions affecting resource revenues, and training and upgrading of staff to improve the branch's efficiency.

Legislation

The Mineral Revenue Branch administers the revenue provisions of numerous acts, regulations and agreements. Among the more significant are:

The Mineral Resources Act, 1985
- The Petroleum and Natural Gas Regulations, 1969
- The Oil and Gas Incentive Regulations
- The Mineral Dispositions Regulations, 1985 including Uranium Royalties
- The Delayed Payment Charges Regulations, 1970

The Oil Well Income Tax Act and Regulations

The Freehold Oil and Gas Production Tax Act and Regulations

The Mineral Taxation Act, 1983
- The Freehold Coal Production Tax Regulations
- Regulations pertaining to Mineral Rights Tax

The Crown Minerals Acts, 1985

The Potash Resource Payment Agreement

Revenues

A decrease of almost 12 per cent in total resource revenues was experienced during this fiscal year. Total revenue during 1985-86 amounted to $774.4 million, a decrease of $101.3 million over 1984-85.

Source of Revenue	1985-86	1984-85	Per cent Increase (Per cent Decrease)
Heritage Fund			
Oil and Gas	$687,268,742	$750,009,211	(8.4)
Potash	32,592,497	71,176,437	(54.2)
Uranium	36,269,443	5,169,013	44.1
Other Minerals	12,856,237	19,495,501	(34.1)
Total	$768,986,919	$865,850,162	

Consolidated Fund			
Mineral Land Tax	$ 3,353,370	$ 3,762,329	(10.9)
Interest and Penalty	4,897	2,858	71.3
Sales, Services, etc.	282,392	306,699	(7.9)
Receipts from other Governments	1,814,307	1,700,735	6.7
Total	$ 5,454,966	$ 5,772,621	

Incentives and Compensations

Payments under The Oil and Gas Incentive Regulations during the year were $18.3 million, compared with $21.9 million in 1984-85.

Compensation payments to former mineral owners were $2.6 million in 1985-86, equalling the amount paid in 1984-85.

Certain mineral rights surrendered to the Crown were encumbered by gross royalty trust certificates. As these lands are leased and brought into production, the branch pays the applicable gross overriding royalty. Payments in 1985-86 totalled $230,992 compared to $187,031 in 1984-85.

Number of Accounts	Type of Account	Reporting Frequency
500	Operator Statements	Month
124	Net Royalties	Month
9,000	P & NG Lease Rentals	Annual
50	Mineral Lease	Month
40	Compensatory Royalties	Month
25	Potash	Month/Quarter/ Annual
45	Uranium and Sodium Sulphate	Month/Quarter/ Annual
800	Coal	Month/Quarter/ Annual
500	Quarrying	Month/Quarter/ Annual
70	Salt and Other Minerals	Month/Quarter/ Annual
1,200	Mineral Rights Tax	Annual
110	Miscellaneous Sales	Month

Administrative Services Branch

This branch's prime objective is to facilitate the delivery of departmental programs by providing administrative support services efficiently and effectively.

Responsibilities include: management of the Accounts, Drafting and Purchasing Sections; human resources management and on going co-ordination of the productivity improvement program.

Accounts Section

Financial management for the department is co-ordinated through this section. Key responsibilities are to assist in the development of the budget and expenditure control. In addition, expenditures are forecasted and additional funds are obtained where necessary. As priorities change, the reallocation of funds is handled through Accounts. This section is also responsible for accounts payable and maintenance of financial records.

Purchasing Section

This section controls the department's office space by ensuring that the space is of adequate area. Purchasing also co-ordinates physical moves and helps plan office layout and design. As well, the section manages office equipment, furniture and supplies. This includes: the ordering and placing of furniture; maintenance of a central stockroom; supply of telephones, photocopies and word processing equipment; co-ordination of the CVA fleet; and the processing of print requests.

Drafting Section

Services integral to Saskatchewan energy and mining industries are supplied through this section. Activities include: compiling various types and scales of generalized base maps; drafting to plate-ready negative both monochrome and polychrome maps; drafting to the plate-ready negative stage, diagrams and figures for technical reports; maintaining a limited blueprint service for the department; and compiling, drafting and updating the various scales of mineral disposition and permit maps. During the year, the Drafting Section updated well and field maps and worked to convert the old series to a new 1:100,000 scale computerized series. The section is converting key areas of mineral prospecting areas in the north to a 1:50,000 scale rather than the existing 1:30,680 scale. In addition, it is creating a new, tying series of structure contour maps to replace the old series of K-Maps.

Human Resources

The Administrative Services Branch plays an important role in the field of human resources by providing advice on administrative matters to all staff. As well, the branch initiates and co-ordinates training and staff development. A liaison function is performed by the branch in representing the department with central agencies such as Finance, Supply and Services and Personnel to procure funding and services.

Staff training and development, Productivity Improvement Committee members.

System Services Branch

System Services provides planning, management, consulting and co-ordination support functions for the development of new and the maintenance and operation of existing information systems for the department. This includes responsibility for the evaluation and acquisition of computer hardware and software, data-entry, data security and the development and management of the department's computer services budget.

System analysis, development and maintenance are performed by branch staff or co-ordinated with consultant services. The department currently runs eighteen computer systems on a regular production basis.

The automated processes use a variety of equipment and computers. The branch operates a remote job entry terminal that provides the communications link between the department and SaskCOMP computers. In addition, on-line terminals and micro computers are available for on-line data processing, program development and maintenance.

The major projects undertaken this year were:

- implementation of the on-line Well Information System;
- implementation of the Oil and Gas Revenue Billing System;
- development and implementation of an Oil Disposition system to handle deregulated oil prices; and
- acquisition of new remote job entry and data-entry equipment.

Mineral Rights Branch

The Mineral Rights Branch is concerned with mineral land ownership and records. Comprised of three sections, its responsibilities are outlined as follows:

Mineral Land Ownership Section

This section:

- maintains a computerized freehold mineral land ownership base for all taxable parcels of mineral lands that are assessed a mineral land tax;
- prepares and registers all mineral land transfers to the Crown;
- enforces foreclosures under The Mineral Taxation Act;
- interprets and verifies mineral land ownership for various branches of the department and for industry;
- provides historical reviews and data necessary for any legal cases regarding doubtful mineral ownership when the department is involved;
- registers and withdraws caveats that affect Crown mineral lands; and
- registers and discharges builders' liens filed against Crown mineral land dispositions under The Builders' Lien Act.

Mineral Land Records Section

This section:

- maintains a mineral land record of all Crown and freehold mineral ownership, which includes an up-to-date record of all Crown mineral land dispositions in the surveyed area of the province;
- verifies Crown mineral lands available for Crown mineral land disposition sales;
- maintains a record of all Crown mineral lands held subject to various trust agreements. This includes the registration of transfers of the trust certificates and the availability for land disposition sales;
- computes acreage figures for all Crown mineral land dispositions;
- supplies industry upon request, information regarding the disposition or availability of Crown mineral lands; and
- verifies mineral land ownership for every well that is licensed.

Landfile Section

This section:

- maintains an up-to-date computerized landfile with data identifying all completed, producing and expired oil and gas wells in the province. Ownership of each well is identified and the data is used in the collection of oil and gas revenues; and
- verifies new ownership of mineral lands that relate to producing properties.

Summary of Activities

The following table indicates the number of transfers completed during the year under review.

Land Registration District	Transfers	Acreage
Regina	2	320
Total	2	320

Builders' Liens

During the fiscal year 192 liens were registered and 26 discharges were recorded under The Builders' Lien Act.

Caveats

Twelve caveats were placed against delinquent taxpayers' titles and fifteen caveats were withdrawn in compliance with The Mineral Taxation Act. A total of 43 caveat withdrawal notices were filed to remove encumbrances from Crown mineral titles.

The following table indicates the number and acreage of forfeitures completed during the year under review.

Land Registration District	Forfeiture	Acreage
Moose Jaw	3	800
Saskatoon	5	1,283
Humboldt	3	808
Regina	16	875
Total	27	3,766

Marketing/Publications

In September, 1985 the publications office became part of the Marketing/Publications Unit.

This unit's four main functions are to:

- develop and implement marketing strategies for materials and services;
- sell and distribute materials and information to the resource industry;
- prepare and co-ordinate the printing of materials, including technical reports and general information; and
- develop and implement a strategy for handling requests for educational materials.

This reorganization links the development of marketing strategies more directly to the actual preparation of materials and the delivery of services to the industry. Close liaison with the Minister's communications staff ensures effective use of advertising, printing and display budgets.

During 1985-86 activities focussed on improving and expanding those services and materials available to industry.

As part of this promotional strategy, staff attended two provincial trade shows: the Weyburn Oil Show and SaskPec in Regina. Plans are to expand the department's participation in such trade shows in 1986-87.

Sales of publications for 1985-86 totalled $240,438 compared to $157,333 in 1984-85.

Resource Policy and Economics Division

John Reid
Assistant Deputy Minister

The Resource Policy and Economics Division, which combined the original Energy Division with portions of the Mineral Policy and Statistics Branch of the Geology and Mines Division, was established on August 1, 1985.

The Resource Policy and Economics Division conducts research and analysis of policy issues related to energy and mineral resource development. Information and recommendations are provided to government to assist in the formulation of policies respecting such matters as: deregulation of natural gas markets and prices; the rate of development of the province's energy and mineral resources; the pricing and taxation of resources; market development; research, development and demonstration activities; and nonconventional and renewable energy resources. The division also carries out negotiations with the federal government and other provincial governments on issues of mutual concern in the mineral and energy sectors.

Specific objectives of the Resource Policy and Economics Division are to:

- monitor and analyse the resource markets, industry structure and performance, and comparative fiscal systems to provide informed assessments for senior management;
- anticipate emerging issues and assist in the development of appropriate policies, strategies and fiscal instruments with which the department can meet its mandate;
- analyse departmental policies and fiscal instruments to ensure that they remain appropriate and effective in meeting the department's mandate;
- negotiate major federal/provincial fiscal issues and arrangements regarding energy and mineral resources;
- develop and manage royalty and taxation systems in relation to the mineral resources of the province (in order to maintain a balance between a fair economic return to the province and incentives to industry);
- produce timely and accurate forecasts of capital investment, production, royalty revenue and employment in mineral industries;
- develop policies and strategies to promote technologies that will lead to more cost-effective and efficient recovery and utilization of our energy resources;
- design and deliver appropriate research, development and demonstration funding programs; and
- maintain an awareness of, and advise the government on technology issues, problems and opportunities within the energy sector.

Policy Analysis Branch

The four main functions of this branch are to:

- monitor and assess the fluctuations in the external environment in which industry operates, and to co-ordinate the department's economic and revenue forecasts;
- conduct economic and financial evaluations of projects and policies relating to the production, processing, distribution, marketing, pricing and taxation of the mineral and energy sectors;
- develop and recommend policy and strategic options and instruments for the mineral and energy sectors; and
- participate in federal/provincial negotiations on issues of joint interest in the mineral and energy sectors.

To fulfil these responsibilities, the professional backgrounds of personnel in the branch provide a range of skills which enhance its ability to evaluate, co-ordinate and initiate issues or policies. Close liaison with both industry and the other branches of the department ensure that the policies developed are timely, effective and sustainable.

Oil

The branch's primary oil-related responsibilities in 1985 centred around specific policy initiatives developed in conjunction with the Petroleum and Natural Gas Division. Specifically:

- Early in 1985, the details on finalization and implementation of the Western Accord were worked out;
- The existing royalty holiday program was reviewed and extended. Detailed revisions are underway to install a more permanent system by the end of 1986;
- In view of the dramatic fall in oil prices, a temporary survival program, the Saskatchewan Oilfield Employment Program was developed. The main objectives of the program are to maintain wells on production and the employment attendant to that activity.

Drilling rig near Elswick.

In addition to these key policy initiatives, the Policy Analysis Branch began preparation of a heavy oil strategy paper to identify the constraints to the further development of this resource in the province. Continued development of this study is expected in 1986. Further refinements were made to the supply model of drilling activity and crude oil production. The model was disaggregated to Saskatchewan's six producing areas.

Since the signing of the Western Accord and the subsequent deregulation of Canadian prices and markets, the branch has continued to monitor fluctuations in world oil prices, supply and demand and assess their impacts on the Saskatchewan industry. The level of oil prices and price differentials between light and heavy crudes also impinges on the feasibility of the upgrader projects. With the dramatic decline in world oil prices since late 1985, this work has taken on heightened importance.

The branch also addresses specific policy concerns, which in 1985 included such issues as:

- proposed tax changes in the U.S.A. and particularly the possible threat of oil import fees in the U.S.A.;
- federal tax initiatives, particularly those related to the Investment Tax Credit introduced in the federal budget of February 26, 1986;
- world oil price stability;
- the implications of the Nielson Task Force report on the resource industries in the province;
- tax and royalty changes in other producing provinces, particularly Alberta;
- federal government policy regarding "Canada Lands"; and
- the role of small Saskatchewan companies in the local industry.

Natural Gas

The Policy Analysis Branch continues to work towards the goal of provincial self-sufficiency in natural gas production by the early 1990's. There have been major policy changes on both the provincial and the interprovincial/federal scene which have produced very encouraging results.

At the provincial level, the Premier announced major changes to provincial gas policy in July of 1985. The new policies were directed at improving the natural gas reserve base and deliverability by increasing the market room available to producers and by providing returns to Saskatchewan producers as attractive as those available in other jurisdictions. The major policy initiatives included: permitting short term limited exports of natural gas from the province amounting to 30 billion cubic feet per year, (bcf/year) for five years in exchange for substantial exploration commitments; permitting direct sales from gas producers to major new industrial projects using gas as a feedstock; and a restructuring of the regulated pricing system for gas produced from new gas wells.

Saskatchewan producers have already made major inroads into the direct sale market in eastern Canada. Two major projects; the Co-op Upgrader and a proposed ammonia plant, will be eligible to purchase gas directly from Saskatchewan gas producers.

The policy changes have had a significant impact upon the Saskatchewan gas industry and the province's economy, as indicated by the following figures:

- Drilling continued at high levels in 1985 - 437 gas wells were drilled, compared to 13 in 1982;
- Total gas production rose from 1.62 billion cubic metres, (bcm) in 1982 to over 2.35 bcm in 1985. Saskatchewan gas supplied about 57 per cent of the province's needs; and
- The total value of land sales in gas prone areas in 1985 reached $21.4 million, almost double any previous year's total.

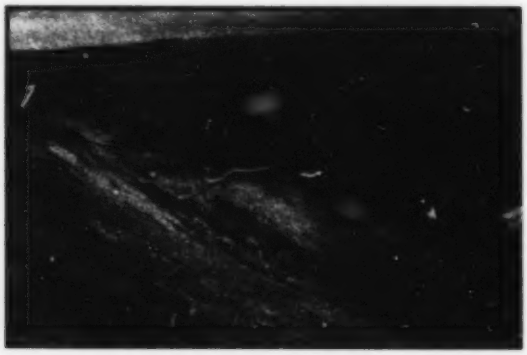
Major changes to the interprovincial natural gas regulatory regime also occurred in 1985. The province participated in the discussions leading to the historic October 31, 1985 federal-provincial Agreement to Deregulate Interprovincial Gas Markets. As a result of the agreement, important benefits are accruing to the province: SPC receives the benefit of the transportation assistance program, which will result in a saving of about $600,000 in gas transport costs; in the fall of 1986, SPC will be able to renegotiate a reduced price for natural gas imported from Alberta; and the agreement has freed up access for Saskatchewan gas producers to markets outside the province.

The Policy Analysis Branch continues to look for opportunities to increase the amount of Saskatchewan gas used in the province. Industry response to past initiatives has been very encouraging and it is expected that the province's goal of self-sufficiency will become a reality by the early 1990's.

Coal

The role of the branch with respect to the coal industry in Saskatchewan includes a number of continuing responsibilities: assessment of tax and royalty schemes levied on coal production; development of coal supply, demand and revenue forecasts; and preparation of coal-related briefing material.

During 1985-86, branch staff continued a review of the coal lease disposition policy by examining alternative lease disposition schemes with the objective of increasing the security of tenure of leaseholders and simplifying the regulatory framework in which leaseholders must operate. Branch staff continued discussions with industry to work toward identifying an active role for the government in enhancing the marketability of coal.



Open pit, Gaertner ore body at Key Lake.

Potash market development in China.

Uranium

During the year under review, the branch's principal responsibility in the uranium sector was the evaluation and analysis of policy issues affecting the province's uranium producers, particularly policies implemented by the federal government. The federal government's restatement of its further processing policy for uranium is still not to the province's liking. The province continues to press federal officials to abandon this policy.

Branch staff also contributed to the federal reviews of foreign ownership restrictions imposed by the Canadian government. A less onerous policy would enable continued resource development to benefit from increased foreign investment capital.

Branch staff continued to monitor industry activity and consult with industry officials to ensure the maintenance of a healthy investment climate. After the U.S. Department of Energy determined the American domestic uranium industry was nonviable, efforts were made to gain more co-operation among industry and federal government officials to ensure the decision would not result in the imposition of uranium import tariffs or quotas.

The Policy Analysis Branch also participated in the review of the uranium royalty system being conducted by the Fiscal Management Branch.

The Policy Analysis Branch assumed responsibility for the uranium public relations function which was previously handled by Geology and Mines.

Potash

The branch's work in potash policy in the fiscal year concentrated on market analysis and market development. The branch maintained a scan of the potash market environment and prepared a monthly potash market report to keep senior management informed of the most recent market developments. To gain a better understanding of the market fundamentals, an econometric study of the factors affecting the demand for potash in the U.S., Saskatchewan's major potash market, was undertaken.

To further market development, the branch organized with industry a one-day conference in Ottawa to make federal government officials aware of the importance to the province of developing future potash markets in Asia and to promote greater co-ordination of effort in this regard. The branch also provided analytical work support for Saskatchewan's representations to the federal government regarding a fertilizer bulk-blending plant. Lastly, the branch organized a joint federal-provincial-industry potash market development intelligence study focussing on Asia that will continue into the 1986-87 fiscal year.

Metallic Minerals

The branch assumed responsibility for monitoring and evaluating issues pertaining to all aspects of the development, production, taxation and marketing of metallic mineral resources, (excluding uranium).

Branch staff participated in joint industry/government working groups which drafted The Mineral Disposition Regulations, 1986 and The Crown Mineral Royalty Schedule, 1986 which incorporated the incentive measures announced in the Mineral Industry Recovery Program.

The branch participated in interdepartmental committees addressing issues facing this sector of the industry and continued to monitor industry activity and liaise with industry officials to promote increased development activity in this sector.

Fiscal Management Branch

During the 1985-86 fiscal year, the Fiscal Management Branch was created largely from the Mineral Policy and Statistics Section of Geology and Mines as part of a reorganization.

The branch monitors, evaluates, designs and implements mineral tax/royalty systems, incentive systems and prepares forecasts of mineral production, revenue and expenditures. The main minerals considered are potash and uranium.

Specific responsibilities of the Fiscal Management Branch are to:

- monitor and evaluate the development, production, taxation and marketing of mineral resources;
- monitor, evaluate and analyse the impact of royalties and taxation on the industry and recommend changes;
- conduct analyses of the investment climate in the province;
- monitor and assess transportation issues related to potash;
- develop, implement, administer and monitor incentive programs in market development and research and development;
- prepare briefing material and position papers to inform senior management of emerging issues and changes in the sector; and
- assist in the development of policy and strategic options related to the mineral resource sector.

Potash

During the year, the major emphasis was on completion of the two year extension of the Potash Resource Payment Agreements, including the implementation of the incentive programs. A part of the incentive program was the development of agreements with the Potash and Phosphate Institute of Canada which provided assistance to expand its international program and move its head office to Saskatoon.

Work began in October to develop a replacement for the Potash Resource Payment Agreements that expire at the end of 1986. As part of the replacement process, the branch provided industry with a number of tax analyses to demonstrate the impact of alternative tax systems.

Assistance was given to industry officials, departmental staff and other government agencies in the interpretation of the agreements and regulations. Statistical and operational information with respect to the potash sector was provided also.

Uranium

Throughout the fiscal year staff members monitored the performance of the industry and of world uranium markets. There was a modest but steady firming of markets during the year. For the first time since the advent of the civil nuclear power industry, reactor consumption of uranium actually exceeded mine output during 1985. Spot market prices started the fiscal year at a 15 year low, in real terms, but rose 15 per cent during the year. The long downward trend in average Saskatchewan selling prices also reversed during the year, with a modest 3.7 per cent improvement over the previous year. Although prices are still at relatively low levels, they were sufficient to ensure that the low-cost producers of the Athabasca Basin remained profitable.

Production declined marginally for the year due to reduced levels of throughput at the Rabbit Lake operation, where test milling of the first of the Collins Bay ore commenced near the end of 1985.

On the other hand, sales volumes increased 25 per cent. This increase reflected continued success in marketing Key Lake concentrates, the incremental effect of the Cluff Lake Phase II project, and an unusually high level of spot market activity during the first half of the year which helped to trim some accumulated producer inventories.

Section staff continued to monitor the evolving trends in marketing activity and pricing.

Staff also participated with the Policy Analysis Branch and Mineral Revenue Branch in an ongoing review of the uranium royalty. Consultations with industry continued with respect to the review and modification of the royalty. Implementation of amended royalty regulations is expected in the fall of 1986.

Technology Branch

The Technology Branch is responsible for co-ordinating and promoting the development of innovative technologies related to petroleum and lignite coal. Since Saskatchewan has very significant reserves of these energy resources, substantial benefits will be derived from finding more efficient or cheaper ways to recover and utilize these resources.

To accomplish its objective the branch:

- develops and delivers funding programs to support research, development and demonstration, (r,d&d) projects related to petroleum and lignite coal; and
- maintains awareness within Saskatchewan of new developments in technology related to petroleum and lignite coal by monitoring r,d&d activities ongoing in Saskatchewan, Canada and internationally.

The Technology Branch is also responsible for any alternative energy and energy conservation issues referred to the department.

In order to carry out its responsibilities, the branch administers the following program:

The Heavy Oil/Fossil Fuels Research, Development and Demonstration Program

This program is intended to encourage research, development, and demonstration of new technologies that facilitate the expanded production and use of Saskatchewan's fossil fuel resources. The program places particular emphasis on heavy oil, with lesser, but still significant emphasis on the enhanced recovery of light and medium oils, and on lignite coal.

Saskatchewan's large reserves of heavy oil and lignite coal have the potential to contribute significantly to Canada's energy supply and to Saskatchewan's economic development. However, technical barriers hinder the expanded production and fuller utilization of these resources.

The high density and high viscosity of heavy oil combined with the thin, unconsolidated sandstone reservoirs in which it is found make it difficult to

produce. Only 5 per cent of the heavy oil-in-place can be produced by primary recovery techniques. As well, heavy oil is difficult to transport and needs to be upgraded to increase its utilization.

Lignite is a low quality coal. Its high moisture and high ash content and hence, low energy content limit its utilization and its economic transportation range.

The governments of Saskatchewan and Canada established the Heavy Oil/Fossil Fuels R,D&D Program to help remove technical barriers to the expanded production and use of these resources. The Heavy Oil/Fossil Fuels Program is being implemented under two federal-provincial agreements:

- The Canada-Saskatchewan Heavy Oil Agreement, signed in 1976, and
- The Canada-Saskatchewan Heavy Oil/Fossil Fuels Agreement, signed in 1983.

As of March 31, 1986 these two agreements will make available a total of $26.3 million until March 31, 1988 for the funding of projects approved under the terms of the program.

Two of the program's major accomplishments in 1985-86 were:

- The Heavy Oil/Fossil Fuels Program previously provided funding to a small field pilot project which was testing the potential improved recovery from the Viking Sand reservoirs in the Dodsland area using a novel waterflood scheme. The novel waterflood technology proved to be so successful that the oil company which was involved in the pilot and its partners invested over $12 million in a commercial-scale project to utilize the technology in a larger portion of the reservoir.
- On June 1, 1985 the Saskatchewan Research Council, (SRC) and Saskatchewan Energy and Mines jointly announced the establishment of the Petroleum Division of the Saskatchewan Research Council. The new division was established through the transfer of the former Research and Development Division of Saskoil to the SRC. The transfer allowed the organization to broaden its base of financial support and technical impact to include the entire Saskatchewan oil industry instead of just one operating company. The establishment of the Petroleum Division was made possible because of the financial support provided for its activities by the Heavy Oil/Fossil Fuels Program.

In 1985-86 the Heavy Oil/Fossil Fuels R,D&D Program provided over $2.8 million in funding to twenty-three projects including:

- **Characterization and Treatment of Saskatchewan Heavy Oil Emulsions**

  Many processes for the recovery of heavy oil involve heating the reservoir to reduce the viscosity of the oil. The heat generated by such thermal processes causes a large number of chemical reactions in the oil and often creates a very viscous mixture of oil and water called an emulsion. This project is developing an understanding of why and how emulsions are formed and is investigating new techniques for the treatment of emulsions in order to aid industry to reduce the problems associated with the formation and treatment of emulsions during the recovery of heavy oil.

Emulsions Laboratory, SRC Petroleum Division.

- **Development of an Automatic Variable Speed Controller for Heavy Oil Applications**

  The project involves the design, manufacture and field test of an automatic control system for electrically operated heavy oil pumps. The new system enables a conventional pump controller and a variable speed motor control to function as an overall system to optimize heavy oil production rates.

- **Evaluation of Upgrading Characteristics of Saskatchewan EOR Feedstocks and Distillate Fractions**

  There is a wide variation in the characteristics of Saskatchewan heavy oil, depending on the location from which the oil was produced and the type of enhanced oil recovery technique employed to produce the heavy oil. This variation in the characteristics can affect the operation of a heavy oil upgrader. During this project, autoclave tests are being conducted on selected Saskatchewan crudes to determine the effect that they would have on the operation of an upgrader. Tests are also being conducted to determine safe operating ranges for Saskatchewan feedstocks with various catalysts.

- **Demonstration Trial of a Continuous Surface Mining Machine**

  Most of the electricity generated in Saskatchewan is produced by large coal-fired thermal power plants. The coal that is burned in these plants is obtained from nearby open pit mines. This project is demonstrating and evaluating the performance of a continuous surface mining

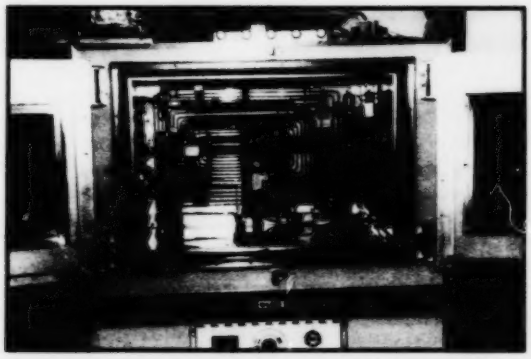
machine in order to determine if this new piece of mining equipment can improve the efficiency of an existing open pit coal mine. If the surface mining machine proves to be more efficient than the equipment presently used in Saskatchewan coal mines, then mining efficiency may be improved.

- **Combustion Tube Studies of Saskatchewan Reservoirs**

  Because of the thinness of our heavy oil reservoirs, it is thought that in-situ combustion is one of the potentially most promising thermal enhanced oil recovery processes for Saskatchewan heavy oil. During the in-situ combustion process, the reservoir is ignited and air or oxygen is injected into the reservoir to maintain combustion. The slowly burning oil in the rock produces heat which reduces the viscosity of nearby oil, allowing this oil to move toward a nearby producing well. The project is estimating the overall potential of in-situ combustion in Saskatchewan and identifying those reservoirs most suitable for enhanced oil recovery by in-situ combustion.

Other projects which received funding in 1985-86 under the terms of the Heavy Oil/Fossil Fuels R,D&D Program are:

- Thermal Studies of Saskatchewan Heavy Oil Core Samples.
- Fluid Characterization of Saskatchewan Reservoirs.
- Enhanced Heavy Oil Recovery by Carbon Dioxide Injection.



Core displacement apparatus used in Enhanced Oil Recovery.

- Enhanced Oil Recovery by Steam Injection.
- High Pressure Miscible Displacement in Saskatchewan's Light and Medium Oil Reservoirs.
- Data Base for the Heavy Oil Laboratory.
- Sand Control Studies.
- Scoping Study of a Novel Recovery Process for Saskatchewan Heavy Oils.
- Pyrolysis and Oxidation of Saskatchewan Heavy Oils.
- Evaluation of Transportation Options for Heavy Oil in Saskatchewan.
- Coal Liquefaction Study.
- Numerical Simulation in Reservoir Engineering.
- Studies of Factors Affecting the Formation of Microemulsions from Saskatchewan Heavy Oil.
- Lloydminster Area Processing Study.
- API Gravity Improvement of Saskatchewan Heavy Oils Using Low Conversion Upgrading Processes.

Further information is available from the Technology Branch regarding the projects funded under the Heavy Oil/Fossil Fuels R,D&D Program.

Geology and Mines Division

Les Beck
Executive Director

The division is responsible for all geoscientific activities by the department: storage and synthesis of exploration, mining and production data submitted by the mining and petroleum industries: and disposition of all Crown mineralc other than petroleum and natural gas, oil shales and helium. The primary objective of the division is to promote exploration and development opportunities for the petroleum and mineral industries in the province through publications, up-to-date technical inventories, core collections, symposia, open house meetings and individual consultations.

In September, 1985 the Mineral Policy and Statistics Unit was disbanded. The mineral policy advisors were transferred to the newly formed Resource Policy and Economics Division and the statistics function was transferred to the Mines Branch of the Geology and Mines Division.

Geological Survey Branch

The Geological Survey Branch is responsible for management of the geoscientific inventory of the province, especially with respect to petroleum, coal, potash, other industrial minerals such as kaolin, bentonite, sodium sulphate and the metallic minerals, particularly uranium, gold, copper and zinc.

Mineralized core collection display, 1985 SGS Open House.

In keeping with this mandate the Geological Survey:

- conducts mapping projects and investigations of the rock systems in the province to provide the regional framework for decisions by industry in its search for additional reserves of current mineral commodities, as well as new oil and mineral deposits;
- maintains for use by government agencies, industry and the public, up-to-date libraries of geological data related to those resources, and the consultative expertise appropriate to their use;
- promotes the resources of the province through open house meetings with industry, sponsorship and support of symposia, and liaison meetings with geological surveys of the other provinces and the national petroleum and mineral associations.

The geological framework of Saskatchewan is made up of a wide range of rock types. Consequently, the province is endowed with an unusual variety of minerals spread from one border to the other, (Figure 1). To provide the service and expertise required, the Geological Survey is organized into four sections; Precambrian Geology, Mineral Development, Geodata and Industrial Minerals and Petroleum Geology. Responsibilities are detailed as follows:

Those mineral industry activities which demanded the most attention in 1985 were: petroleum and natural gas by virtue of record-breaking exploration and development; potash, because of water breakthroughs endangering two of the mines; and kaolin and gold for their high growth potential as new industries for Saskatchewan. Apart from an all out successful effort to cope with the massive inflow of data from petroleum related activities, the bulk of the budgetary operational resources was concentrated on the Precambrian Shield of northern Saskatchewan in support of the rising level of gold exploration.

The year under review was the second in the five-year $6.38 million Canada-Saskatchewan Mineral Development sub-agreement of the Economic Regional Development Agreement. The program under sub-agreement was carried out in two sectors:

- northern Saskatchewan, as field mapping projects and mineral deposits studies of the La Ronge-Reindeer Lake-Flin Flon gold-bearing region. Work was performed collaboratively by the Precambrian Geology and Mineral Development Sections and the Geological Survey of Canada; and
- southern Saskatchewan, where contracts were let for assessment of limestone deposits as building stones and dry beneficiation of potash ore underground by Canmet and the Industrial Minerals Section.

In house studies of the subsurface formations of southern Saskatchewan were reduced to two in the Lloydminster region because of the involvement of staff in handling the petroleum data overload. However, a co-operative program of investigation for strata with hydrocarbon source potential was initiated through the Geological Survey of Canada with funding from the Office of Energy Research and Development. Success in this program will enable a better focussed search for new petroleum prospects beyond the present heavily explored districts.

The 1985 Annual Open House of the Geological Survey was attended by 250 and included participation from the Universities of Saskatchewan and Regina, the Saskatchewan Research Council and members of industry. The event provided a synopsis of the geological work being done in the province by public agencies.

Figure 1
Location of Major Mineral Deposits, Saskatchewan

U: Uranium
G: Gold
C-Z: Copper-Zinc
C: Coal
I: Iron
K: Potash
M: Methane
P: Petroleum
▲ Sodium Sulphate
⚒ Operating Mine

Editorial and Cartographic Unit

The unit is responsible for the editing and production of all geoscientific reports and maps published by the branch. During the fiscal year, 23 publications, (listed as follows), comprising 1,405 pages and 53 maps, were produced. One report was reprinted. This represents an increase of 14 per cent in terms of pages and 20 per cent in terms of maps over the previous fiscal year. Approximately 25 per cent of the cartographic staff's time was spent on special projects, such as text figures for technical articles and papers in scientific journals, slides for conference presentations and graphics for conference displays.

Development and testing of a fully functional remote typesetting facility capable of handling all reports and map legends was completed during the year. Benefits already noticed include: reduction by 50 to 75 per cent in the time and costs involved in typesetting; elimination of typographical errors introduced at the typesetting stage; and increased flexibility, since the codes for typesetting can be incorporated using either the departmental word-processing system or any IBM-PC compatible microcomputer.

1985/86 Publications
Reports:

Fuzesy, A. (1985): Assessment work catalogue, La Ronge Mining District; Saskatchewan Energy and Mines, Miscellaneous Report 85-5, 126p (supplement to Miscellaneous Report 79-4).

Fuzesy, A. (1986): Assessment work catalogue, Reindeer Mining District; Saskatchewan Energy and Mines, Miscellaneous Report 86-5, 80p (supplement to Miscellaneous Report 82-10).

Gilboy, C.F. (1985): Basement geology, part of the Cree Lake (South) area; Saskatchewan Energy and Mines, Report 203, 47p.

Gilboy, C.F. (1985): Compilation bedrock geology, Cree Lake, NTS area 74G; Saskatchewan Energy and Mines, Report 237 (1:250,000 scale map with marginal notes).

Lane, D.M. (1985): Souris River Formation in southern Saskatchewan; Saskatchewan Energy and Mines, Report 92, 72p (reprint of a report originally published in 1964).

Lewry, J.F. and Slimmon, W.L. (1985): Compilation bedrock geology, Lac La Ronge, NTS area 73P/73I; Saskatchewan Energy and Mines, Report 225 (1:250,000 scale map with marginal notes).

Macdonald, R. and Slimmon, W.L. (1985): Bedrock geology of the Greater Beaverlodge area, NTS 74N-6 to -11; Saskatchewan Energy and Mines, Map 241A, scale 1:100,000.

Macdonald, R. et al., eds. (1985): Summary of Investigations 1985, Saskatchewan Geological Survey; Saskatchewan Energy and Mines, Miscellaneous Report 85-4, 202p.

Thomas, M.W. (1985): Compilation bedrock geology, Ile-a-la Crosse, NTS area 73O; Saskatchewan Energy and Mines, Report 245 (1:250,000 scale map with marginal notes).

Troyer, D.R. (1985): Peat resources in Saskatchewan; Saskatchewan Energy and Mines, Report 218, 74p.

Open Files and Data Files:

Geological Survey of Canada (1985): Regional lake sediment and water geochemical reconnaissance survey (NTS 64E and parts of 74A and H); Geol. Surv. Can., Open File 1106, 92p. (incl. 20 maps)/

Geological Survey of Canada (1985): Regional lake sediment geochemical reconnaissance data (NTS 63M, 64D and parts of 63K, L, N, 73I, O, P and 74A);p Geol. Surv. Can., Open File 1129, 150p (incl. 8 maps)).

Lee, N. (1985): Index to Precambrian Original Data (POD) File (to Nov. 14, 1985): Saskatchewan Energy and Mines, Data File 5, 39p.

Parslow, G.R. and Gaskarth, J.W. (1986): Geochemistry of the Hanson Lake area; Saskatchewan Energy and Mines, Open File Report 86-1, 106p.

Salt, D.P. (1986): Annotated bibliography of theses on the geology of Saskatchewan; Saskatchewan Energy and Mines, Data File 10, 105p.

Scott, B.P. (1985): Geology of the Upper Clearwater River area; Saskatchewan Energy and Mines, Open File Report 85-2, 26p.

Slimmon, W.L. and Bing-Wo, R.J. (1985): Ile-a-la-Crosse geological bibliography (NTS area 73O); Saskatchewan Energy and Mines, Data File 7, 6p.

Slimmon, W.L. and Bing-Wo, R.J. (1985): Lac La Ronge geological bibliography (NTS area 73P/I); Saskatchewan Energy and Mines, Data File 9, 15p.

Thomas, D.J. (1985): Geology of the Forsyth Lake (east) area; Saskatchewan Energy and Mines, Open File Report 85-4, 28p.

Thomas, D.J. (1986): Geology of an area around Star Lake; Saskatchewan Energy and Mines, Open File Report 85-6, 83p.

Thomas, M.W. (1985): Cree Lake geological bibliography (NTS area 74G); Saskatchewan Energy and Mines, Data File 8, 6p.

Wilson, M.A. and Bennett, R.W. (1986): Evaluation of Saskatchewan's heavy oil reserves; Saskatchewan Energy and Mines, 25p.

Precambrian Geology Section

The Precambrian Geology Section compiles and maintains a regional geoscience inventory of northern Saskatchewan to promote and assist in regional development, particularly the mineral exploration industry. This function is achieved through office compilation and a field-based program. Summer project results are reviewed each year at an open house meeting with the mineral industry and the coincident release of a summary technical report of activities. Field projects are

mounted by branch staff, university contractors and outside consultants. Project and compilation reports and maps, open files and data files are also issued.

The section maintains a number of geoscience data bases and is currently engaged in computerizing them. These data bases include regional rock samples, geochemical, technical literature and other files.

A coloured compilation bedrock geology map series of the Precambrian Shield area at 1:250,000 scale is now more than 50 per cent complete, (Figure 2). The Lac La Ronge sheet, (NTS areas 73-P and 73-I) which contains much of the current gold play terrain and a 1:100,000 scale map of the Greater Beaverlodge area were released.

In 1985-86, field project operations, (Figure 3) were again funded under the Canada-Saskatchewan Subsidiary Mineral Development Agreement 1984-89, in its second year. The 1985-86 budget of $638,000 was administered by the Precambrian Geology Section and to a lesser extent the Mineral Development Section. The Geological Survey of Canada provided a counterpart program, largely comprising airborne geochemical and geophysical surveys and some detailed mineral deposit and regional geological studies.

The provincial "Gold Belt Geology" program comprises a number of projects ranging from detailed bedrock mapping to detailed mineral deposit and geochemical studies in areas perceived to have the highest potential for gold exploration, especially in the triangle of country between La Ronge, Reindeer Lake and Flin Flon.

Bedrock mapping continued in the Central La Ronge Metavocanic Belt at 1:20,000 scale, with two field parties, (A & B, Figure 3). This was the second year of the mapping program, which is expected to be completed as far south as Missinipe by the end of 1986-87. This part of the La Ronge region is currently regarded as the most promising gold exploration terrain in the province. The open file reports issued and the presentations made to the mineral industry have provided regional criteria for gold exploration targets in the belt.

Geological Survey staff at Star Lake trenches.

These mapping projects were supported by geochemical studies in the La Ronge region contracted to the University of Regina, (C, Figure 3). The University of Regina, (D, Figure 3) was also contracted to initiate geochemical studies in the area north and northwest of Flin Flon with a view to tracing possible extensions of a neighbouring major mineralized zone from Manitoba. Preliminary results from this study are positive.

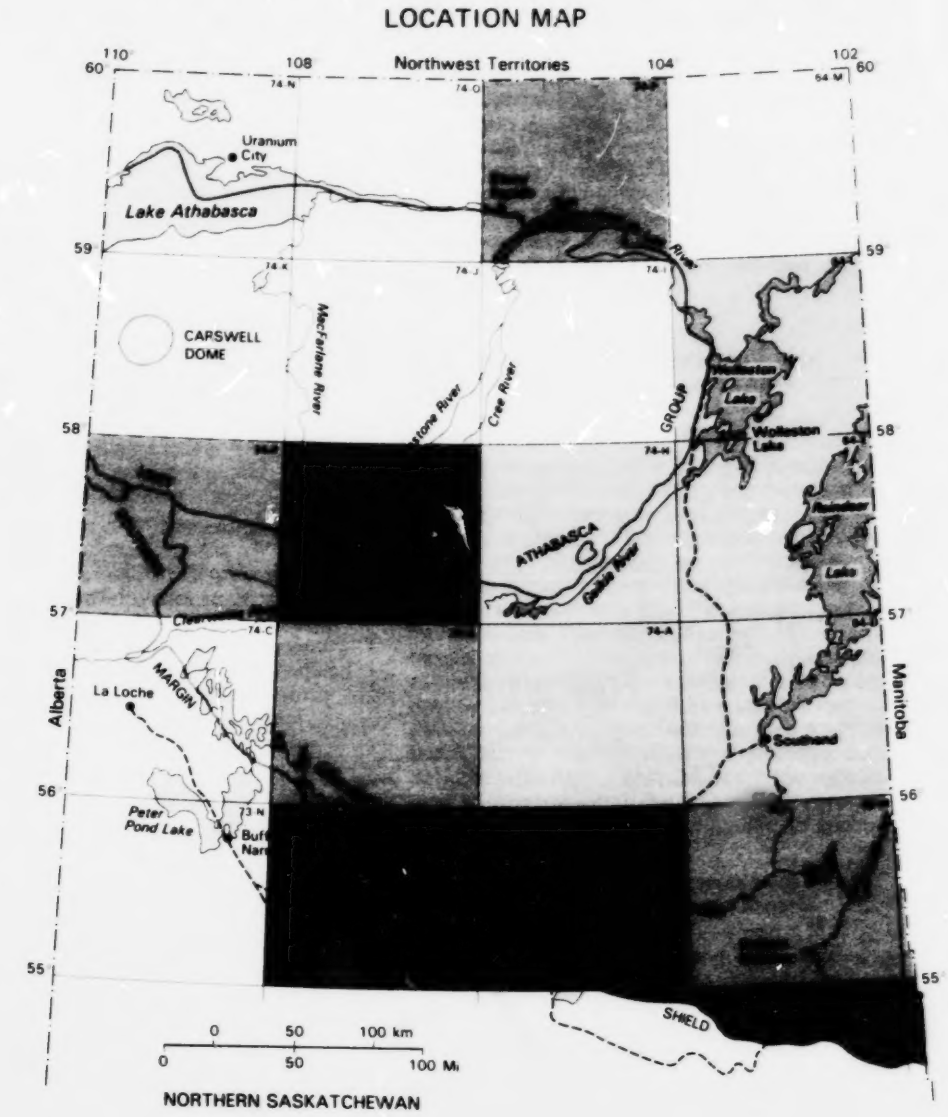
The year under review was the final year of a program to test biogeochemical exploration methodology, (E, Figure 3). Results show positive relations between plant uptake of gold and mineralized zones and established the value of this technique in exploration for gold in glaciated terrains such as northern Saskatchewan.

Geochronological and isotopic studies were contracted to Carleton University, (F, Figure 3) and the University of Regina, (G, Figure 3). A joint program of geochronological determinations was continued into the third year with Kansas University. These determinations help to provide a chronological framework for classifying bedrock units in the north leading to improved models for mineralization.

A joint agreement was entered into with the Saskatchewan Research Council to prepare a report on the Quaternary (glacial) geology of the La Ronge-Reindeer-Flin Flon triangle area as a guide to methodology for gold exploration, (H, Figure 3).

A number of other smaller projects rounded out the year's field program including the third year of a study of the Martin Group near Uranium City, contracted to the University of Saskatchewan, (I, Figure 3) and a study by the University of Regina of the Precambrian basement encountered in deep wells in the southern part of the province.

Figure 2
Precambrian Bedrock Geology Maps,
1:250,000 Scale

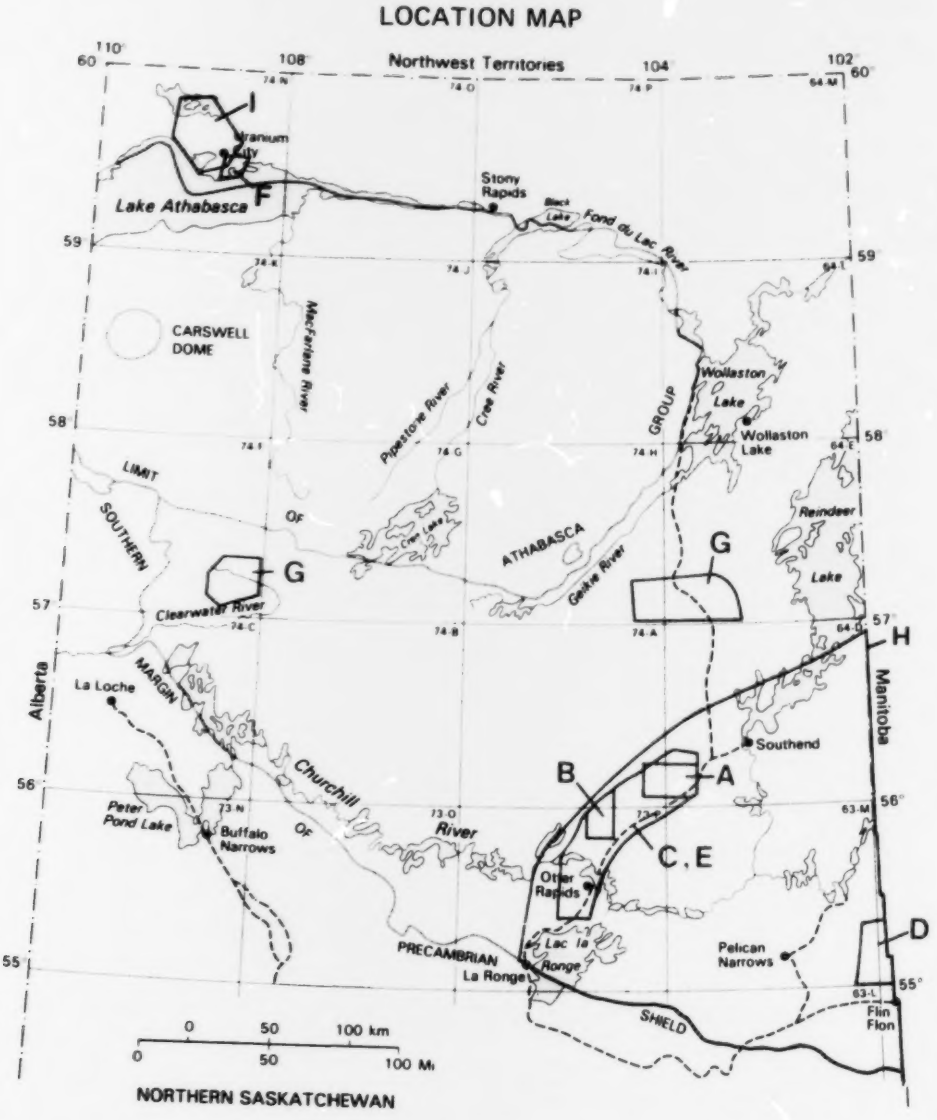


Full colour edition published 1985-86

Preliminary monochrome edition published prior to 1985-86

Full colour edition published prior to 1985-86

Figure 3
Precambrian Geology Field Projects



Mineral Development Section

The section is responsible for maintenance of the mineral exploration assessment files and the Saskatchewan Mineral Deposits Index: evaluation and geological studies of metallic mineral deposits of northern Saskatchewan; and programs run through the offices of the resident geologists in La Ronge and Creighton. In addition, the section disseminates information about metallic mineral deposits, mineral industry activities and mineral development opportunities in northern Saskatchewan at both a technical and general level.

A total of 590 mineral exploration assessment files submitted under the Mineral Disposition Regulations were processed, 178 visitors received and 118 requests for information handled. Two indexes to assessment files for the Reindeer and La Ronge Mining Districts, were published.

Work continued on the Saskatchewan Mineral Deposits Index with documentation of 117 new occurrences and updating. The index provides a primary reference for mineral exploration and land use planning. A total of 18 major requests for index data was handled.

Requests for information increased over the previous year, primarily as a result of the current gold exploration boom in northern Saskatchewan.

Studies of gold deposits were ongoing as part of the Geoscience Program under the Canada-Saskatchewan Mineral Development Agreement. These centred on the Goldfields area south of Uranium City and on the Flin Flon-Amisk Lake area. Results of some aspects of this work were presented in two papers to the Canadian Institute of Mining and Metallurgy Symposium, "Gold in the Western Shield", held in Saskatoon in September, 1985.

Section staff also presented a review paper on the world class Athabasca Basin uranium deposits to an International Atomic Energy Authority Conference, "Recognition of Uranium Provinces", held in London, U.K. in September, 1985.

The mineralized core collection, stored in La Ronge and administered through the office of the resident geologist, received additions totalling some 3,925 m from the Dawn Lake 11A and B, Cluff Lake, Dominique-Peter, Fond-du-Lac, and Stewart Island uranium ore bodies; four other uranium projects in the Athabasca Basin; and several gold properties in the La Ronge and Flin Flon Belts. Ninety people examined cores from the collection during the fiscal year.

The series of 1:250,000 scale metallogenic maps established in 1984-85 received ongoing attention, and although no new maps were published, two were in an advanced stage at year end. These maps provide details of location, metal association, development status and type of mineralization, as well as reference to information on all noted mineral occurrences. They will augment a similar scale compilation bedrock geology series and provide a valuable reference to the mineral exploration industry.

In conjunction with the La Ronge Community College, the Prospectors School offered a basic six-week mineral prospecting course to students of all ages, primarily from northern communities. A total of 18 students graduated. Reintroduction of the course was deemed particularly appropriate in view of the current interest in gold exploration in northern Saskatchewan.

The resident geologists, through offices in La Ronge and Creighton, monitor mineral exploration activity in northern Saskatchewan and also service the industry by providing up-to-date information on exploration and mining activities and opportunities. The offices maintain files of current mineral claim maps, air photos, geological maps and reports and assessment work submissions for their respective districts. Some 1,800 visits were recorded at the resident geologists' offices.

Geodata and Industrial Minerals Section

Industrial Minerals Unit

The section is responsible for the provision of data and consultation to industry, government and the public on technical matters relating to industrial minerals. It plans and implements special studies and research projects on industrial minerals, monitors exploration and development in the industry and maintains a central repository of technical data. The section also performs a regulatory function in respect to the performance of exploratory work and the submission of technical data by industry. The monitoring of technical developments, industrial mineral and rock utilization, specifications, market trends and relevant industrial developments form a basis on which the section advises government on the potential for mineral development and the need for funding of special projects.

During the fiscal year two projects were initiated under the Canada-Saskatchewan Mineral Development Agreement:

- Potash Mine Geology Project, a four-year project contracted to the University of Saskatchewan to examine geological anomalies in potash mines and develop a predictive methodology.
- Potash Mine Data Compilation, a short-term project designed to compile a bibliography of all available potash mine data relevant to the study of anomalous geological conditions as a basis for developing a standard nomenclature, and a guide for mine research.

The section also provided substantial assistance in the development of projects under the technology and development sectors of the Canada-Saskatchewan Mineral Development Agreement. Other projects of the section include:

- continuation of work on a report on the geology

of industrial minerals of Saskatchewan;

- commencement of a study of the Winnipegosis and Dawson Bay Formations in the Esterhazy-Rocanville-Bredenbury potash mining region;
- completion of a study on the petrology of potash-bearing members of the Middle Devonian Prairie Evaporite in the province;

Investigation of energy peat resources, La Ronge area.

- publication of Report 218, Peat Resources in Saskatchewan; and
- development of the licencing, exploratory and data submission sections of the coal disposition regulations.

The section continues to be involved in the review of technical data and environmental impact statements arising from exploration and proposed development of industrial minerals.

Approximately 170 technical inquiries were handled by the section on a wide variety of industrial minerals. This represents about a 6 per cent increase over the previous year. Figure 4 illustrates the distribution of inquiries.

Figure 4
Distribution of Inquiries

Kaolinized sandy beds of the Whitemud Formation.

Well Records Unit

During the fiscal year a total of 3,162 new well files were created and over 3,300 new wells were added to the computerized well data system.

A temporary substantial increase in staffing resulted in the coding of over 4,200 new wells and amendments to 3,250 wells by the addition of supplementary data or correction of original data.

The unit experienced an increase in demand for information services during the fiscal year. Nearly 32,000 files were pulled for industry and refiled. More than 63,000 pages of data were photocopied and 102 computerized data searches were conducted. About 16,000 submissions of technical data were processed and 1,500 letters requesting overdue information were mailed.

This increase in output was facilitated by conversion from the old computer system to an on-line system with five in-house terminals. This has increased the speed and efficiency of input and retrieval.

Geophysical Unit

Geophysical activity in oil and gas exploration increased markedly in 1985 and was more or less evenly shared by the four main oil-producing districts. Thus there was a corresponding rise in the statistical indicators of services supplied by the unit, as shown in the table following:

	1985	1984
Geophysical Licences issued	108	80
Crew Certificates issued	231	208
Permits issued	342	127
Exploration programs processed, approved and registered	447	n/a
Maps sold to the industry	3,349	2,643
Geophysical data packages for the Petroleum Land Sales	200	200
Total letters of correspondence with industry	2,301	2,000

During the year The Sedimentary Basin Geophysical Exploration Regulations, 1985 were released. The new regulations are more compatible with current trends and techniques of geophysical exploration in the province.

In addition, the following three sets of geophysical index maps were completed: seismic structure contour maps (with accompanying catalogue); seismic shot point maps; and gravity, magnetic and miscellaneous maps. Each set consists of six index maps which cover the southern half of the province from Manitoba to the Alberta border and extending to latitude 56°N.

A composite seismic structure map, SM-1, Souris River area, (southeast Saskatchewan) was completed. Prepared on a scale of one inch to two miles, the map is drawn on the Paleozoic, (Mississippian) unconformity surface and includes the major oil and gas field region of southeast Saskatchewan.

Arrangements were made with the federal Department of Energy, Mines and Resources for the verification of the geophysical programs conducted in Saskatchewan by oil companies for grants under the Petroleum Incentives Program, (PIP).

Administration of The Geophysical Exploration Regulations and relevant parts of The Petroleum and Natural Gas Regulations were carried out routinely. Revision and updating of geophysical maps are being conducted as an ongoing project.

After discussions with industry, the geophysical data acquired from Saskatchewan Heavy Oil Project, (SHOP) lands in the heavy oil region of west-central Saskatchewan were released to the public. Likewise, arrangements were made to release the geophysical data submitted to the unit under the Petroleum Incentives Program. The data covers about 10,000 line miles of seismic survey.

A new filing system was set up for the administration of The Geophysical Exploration Regulations. The system enables the unit to monitor the geophysical activity in the province and ensure that all exploration projects are registered promptly, monthly and final reports and maps are submitted on time and all relevant data is received from the industry.

Petroleum Geology Section

The high drilling rate associated with petroleum and natural gas exploration continued throughout the year and the section gave priority to keeping the Well Information System up-to-date. To this end, 3,985 well logs were picked and the formation tops coded.

The new interactive computer terminal system was installed in November, 1985 and was debugged and working properly by January, 1986. The Petroleum Geology staff then included the entry of formation tops into the system as part of their work load.

Five more cross-sections were added to the grid series intended eventually to cover southern Saskatchewan and lead to standardization and greater speed of log picking.

Two special projects were completed during the year:

- Evaluation of Saskatchewan's Heavy Oil Reserves, produced as a preliminary report. Seventeen extra maps, (Basewater Maps) are currently being compiled as an addendum; and
- Inert Gas Occurrences in Southwestern Saskatchewan, A Potential Source of Carbon Dioxide for Enhanced Oil Recovery. The first draft was completed.

Three projects were initiated:

- Geology of the Dawson Bay Formation in southeastern Saskatchewan.
- Geology of the Medicine Hat Sand in southwestern Saskatchewan.
- Jurassic Geology in the Moosomin Area in eastern Saskatchewan.

Consultation services continued at a high rate, both at a professional level with industry and at a general level with educators, students and members of the public. A close liaison was kept with several graduate students doing theses on Saskatchewan sedimentary geology topics.

The section head underwent training to become a facilitator for the "Communicating For Effective Work Management" program and now has that role added to his duties.

Subsurface Geological Laboratory Unit

During the fiscal year, the laboratory recorded the following activities:

- New core received: 18,473 boxes from 1,289 wells.
- Core now in storage: 261,399 boxes.
- Drill cutting samples washed, catalogued and stored: 27,469 vials.

- Drill cutting samples, washed and catalogued for shipment to Energy, Mines and Resources Canada in Calgary: 24,029 vials.
- Actual samples shipped: 28,588.
- Number of industry users of the laboratory: 188 from 123 firms.
- Number of other users of the laboratory: 18 from 5 establishments.
- Cores examined: 53,625 boxes from 3,764 wells.
- Samples examined: 464 wells.
- Temporary removal of cores from the laboratory: 50 wells.
- Thin sections prepared for staff: 1,289.

The general public, in particular school teachers and their earth science classes, continued to show interest in laboratory building tours. Several such tours, finishing with a brief talk and question period, were conducted during the year. The core examination facilities were also utilized by university students in conjunction with geological course work and theses.

Mines Branch

This branch is responsible for the disposition, development and conservation of all Crown minerals with the exception of petroleum, natural gas, helium and oil shale. The activities of the branch are carried out through the Mining Lands Section and the Mining Operations Section.

Mining Lands Section

Mining Lands administers and disposes of Crown minerals under the following regulations:

- The Mineral Disposition Regulations, 1961 (uranium, base and precious metals)
- The Quarrying Regulations, 1957 (sand, gravel, clay, bentonite and other quarriable substances)
- Alkali Mining Regulations (sodium sulphate)
- The Coal Mining Regulations, 1957 (coal)
- The Subsurface Mineral Regulations, 1960 (potash, salt)

Activities of the section are centred in Regina, but a field office is also maintained in La Ronge to permit local administration of regulations.

A total of 814,520 hectares of new dispositions covering 245 mineral claims, 276 claim blocks and five prospecting permits were taken out under The Mineral Disposition Regulations, 1961, an increase of about 63 per cent from the area taken out in the previous year.

On March 31, 1986 there were 41,231 hectares held under 2,547 mineral claims; 3,138,236 hectares held under 1,157 claim blocks; 1,601,003 hectares held under 26 prospecting permits; and 1,047,234 hectares held under 730 leases. The total area held was 5,827,704 hectares, essentially unchanged from March 31, 1985.

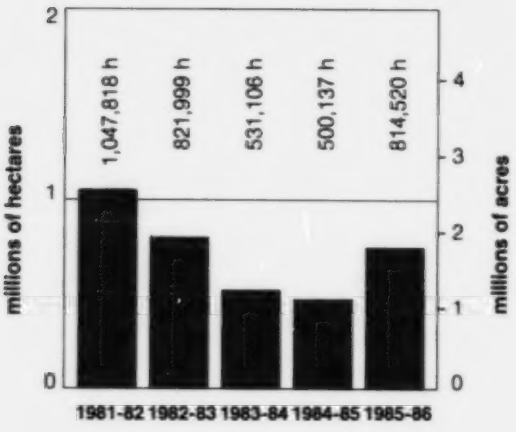
In the year under review, 21 prospecting permits covering 55,355 hectares and 93 leases covering 1,861 hectares were granted under The Quarrying Regulations, 1957. Twelve of the permits were for one or more of sand, gravel, rock and clay, and nine for one or more of kaolinite, sand and clay. Eighty-nine of the leases were for one or more of sand, gravel, rock and clay, of which ten were acquired by Saskatchewan Highways and Transportation, one by Saskatchewan Parks and Renewable Resources, 27 by rural and urban municipalities and 51 by private interests. Two quarrying leases were granted for bentonite and two for kaolin. At year end, 59,109 hectares were held under 30 prospecting permits and 21,078 hectares were held under 1,063 quarrying leases.

One alkali mining lease was issued during the year, resulting in a total of 34 leases covering 9,971 hectares being held at the end of the year.

Seven new coal leases were issued, resulting in a total of 577 leases covering 98,396 hectares being held at the end of the year. Forty-six coal exploration permits, covering 33,387 hectares were also issued, most of them for exploration of deep coal horizons in an area west of Kerrobert.

Potash dispositions remained unchanged, with nine leases and one permit totalling 203,933 hectares being held at the end of the year. An amendment to The Subsurface Mineral Regulations, 1960 was passed in March 1986, which provided a mechanism for individual producing potash leases to be increased every five years.

Figure 5
New Areas Acquired Under Claims, Claim Blocks and Permits



Mining Operations Section

The Mining Operations Section is responsible for administration of sections of The Mineral Disposition Regulations, 1961 governing the conduct and reporting of mineral exploration work programs and for monitoring mining activity.

Exploration Unit

The unit is responsible for evaluating technical data submitted as assessment work by the mineral industry under The Mineral Disposition Regulations, 1961.

Assessment work received during a fiscal year gives an indication of major trends in the level of mineral exploration activity and the geographic areas in which such activity has taken place, although it does not provide a true measure of total exploration expenditures. A total of 943 submissions covering 10 categories of exploration work were received, down about 48 per cent from the previous year.

Exploration expenditures claimed were down 57 per cent from 1984-85, ($13.1 million vs $30.3 million in 1984-85 vs $22.5 million in 1983-84). Approximately 57 per cent of the total reported expenditures was for diamond drilling, and approximately 68 per cent was associated with the search for uranium in the Athabasca Basin, particularly at Key Lake, Cigar Lake and Collins Bay.

Engineering Unit

The major functions of the unit are to:

- monitor development and mining operations pertaining to those minerals for which the branch has responsibility;
- collect, process and maintain records and disseminate data related to mineral production;
- co-ordinate department response to project proposals referred by Saskatchewan Environment as part of the environmental impact assessment process, and specifically to evaluate those proposals pertaining to mining developments; and
- provide technical expertise and assistance to other branches and divisions in the department.

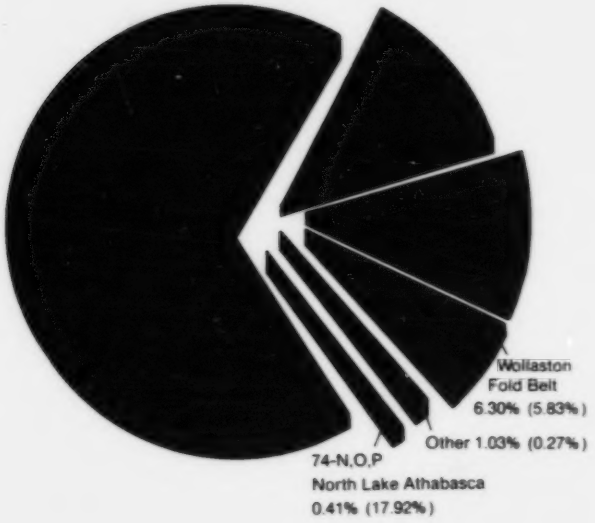
A statistics program pertaining to mineral production was taken over by the unit in November, 1985 as a result of reorganization affecting the Mineral Policy and Statistics Section. Data on amounts and values of output was collected from 28 individual mining operations, and information was supplied to five government departments and agencies and 17 mining companies.

Responsibility for co-ordination of department responses to environmental submissions was taken over by the unit in September 1985. From then until the end of the fiscal year, 17 project submissions were reviewed within the department, three of which dealt specifically with mining operations.

Technical expertise in the unit was used to provide consultative services with respect to three submissions under Potash Resource Payment Agreements, evaluation of the status of research and development projects related to potash and uranium development, and provision of information related to mining operations in response to a total of 24 requests from within and outside the department.

Unit staff represented the department at meetings of an Advisory Committee on Mining Training Needs and a Federal-Provincial Committee on Mineral Statistics.

Figure 6
1985-86 Assessment Work Expenditure Distribution by Region
(1984-85 Comparative Distribution)



Petroleum and Natural Gas Division

Bruce Wilson,
Executive Director

The Petroleum and Natural Gas Division has major responsibilities in all areas related to provincial jurisdiction over oil and gas resources including disposition and management of Crown oil and gas rights; well licensing and surveillance of all exploration, development and production operations; oil and gas conservation including determination of reserves and producibility estimates, maintenance of production and disposition statistics, crude oil marketing, and royalty and tax legislation.

The responsibilities of the division are carried out through the operation of five branches:

- Geology and Petroleum Lands
- Engineering Services
- Economic and Fiscal Analysis
- Petroleum Development
- Petroleum Statistics

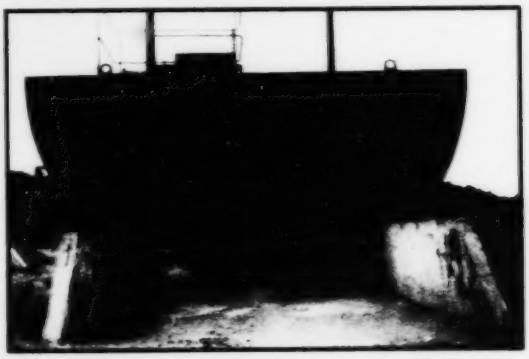
The oil and gas industry continued to make a significant contribution to the Saskatchewan economy during the past year. Industry expenditures in 1985 related to exploration and development activity topped the one billion dollar level. These expenditures accounted for approximately one quarter of the total capital formation in the province. Much of this investment was directed toward new drilling and as a result, another drilling record was estabished. The production of oil and gas increased, but more important, so did the remaining reserves estimates for each resource.

Several policy initiatives helped to promote the strong developmental thrust in 1985. By virtue of the Western Accord signed in March, new developments became exempt from the Petroleum and Gas Revenue Tax while still qualifying for Petroleum Incentive Program grants until March 31, 1986. In June, the province announced that the oil royalty/tax incentive program had been extended to the end of 1986. Furthermore, the province announced additional natural gas policy measures in July which were designed to move the province toward a goal of self-sufficiency in natural gas production.

The transition to a deregulated crude oil marketing system was achieved in a relatively smooth fashion. Because of deregulation, the policy of allocating space within the Interprovincial Pipe Line system, (IPL) was reviewed and amended. The department was largely supportive of the pipe line allocation procedures approved by the National Energy Board, (NEB).

Lack of markets for Saskatchewan crude oil, combined with IPL capacity restrictions, caused significant shut-in problems during the latter part of the fiscal year. The department was pleased, therefore to see NEB approval granted in early 1986 to the most recent IPL expansion plans.

Several studies under the Heavy Oil Project were completed with recommendations presented for new or amended oilfield environmental guidelines. Of note were the new guidelines established for the construction of oilfield ecology pits and the disposal of drilling fluids.



Steel containment process unit, Heavy Oil Project oily waste storage pit study.

The fiscal year ended on a rather uncertain note with oil prices dramatically falling by 60 per cent within a matter of three months. The oil price collapse has threatened the continued operation of many of Saskatchewan's marginal oil wells and severely reduced the economic attractiveness for future exploration and development activity.

Petroleum Development Branch

The Petroleum Development Branch is responsible for ensuring that the field operations of the province's oil and gas industry meet acceptable technical and environmental protection standards and that well licensing proceeds in accordance with regulations established under The Oil and Gas Conservation Act.

The Regina staff:

- directs field office operations;
- processes and approves applications for well drilling licenses;
- enters initial data for the Well Information System;
- maintains records and control of well deposits made to guarantee proper drilling, completion and abandonment of wells;
- processes and approves well ownership and name changes;
- advises of offset drilling commitments on Crown land;
- processes weekly drilling reports and compiles statistical data relating to drilling activity; and
- represents the department on oil spill co-operatives.

Rig servicing near Weyburn.

The field office staff:

- collects and compiles drilling, completion and reservoir data;
- enforces regulations, orders and policies pertaining to pollution control in the oil industry;
- checks standards, procedures and equipment used by industry in drilling, producing and abandonment of wells;
- witnesses production tests;
- performs on-site inspections of all wells and facilities;
- investigates and assists in resolving landowner problems associated with the use of land for exploration and production; and
- investigates, reports and ensures that industry act promptly and efficiently in handling oil and salt water spills.

During the past fiscal year a computerized Well Information System was initiated. This system, when completed will give a fast and accurate account of each well's drilling information, geological information, maximum production rate and actual production. As well as entering the initial well license and drilling information into this system, staff also registered and recorded 726 well ownership changes and 444 well name changes. New freehold producing wells resulted in the need to call 319 offset commitments. The dynamic increase in drilling and influx of new companies resulted in large numbers of inquiries pertaining to drainage unit and target areas for both oil and gas well drilling. Field staff similarly handled vast numbers of inquiries pertaining to drilling, production and abandonment procedures. During the year they carried out in excess of 32,000 well, battery and rig inspections, 738 pressure maintenance/water disposal well checks, 42 landowner complaint investigations, 738 production test observations, and reported on all of the drilling, completion and abandonment work.

Flowline construction, Shaunavon area.

Drilling Activity

Drilling activity in 1985 continued at a record breaking pace. The activity was a direct result of the province's oil recovery program and natural gas policy changes as well as the Western Accord. A record 3,851 oil, gas and service wells were drilled, a 30 per cent increase over the previous record year in 1984.

A breakdown of 1985 drilling activity is as follows: 2,871 completed oil wells, 437 completed gas wells, 42 completed service wells and 501 abandoned dry holes giving an overall success ratio of 87 per cent. There were 3,971 drilling licenses issued in 1985 compared with 3,234 for the previous calendar year.

Figure 7
Wells Drilled

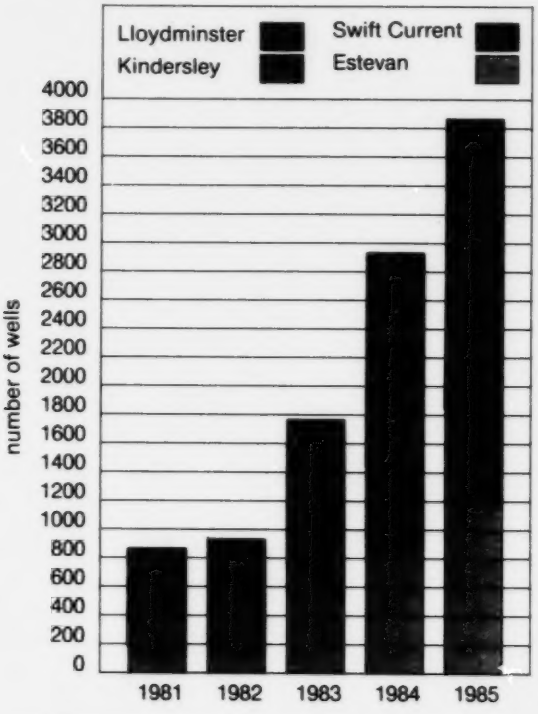
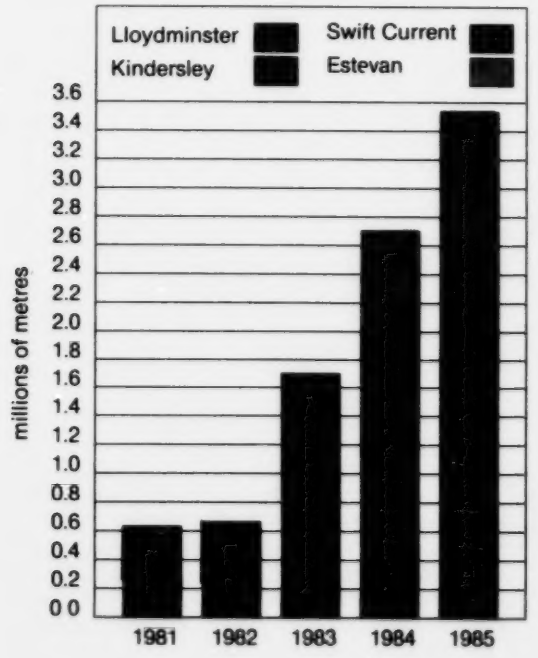


Figure 8
Metres Drilled



Engineering Services Branch

The Engineering Services Branch evaluates Saskatchewan's crude oil and natural gas reservoirs to ensure that exploration, development and production of these resources follow good conservation and engineering standards. Sound management of these resources is essential to achieve efficient production and ensure maximum benefits from development. The mandate for these responsibilities comes from The Oil and Gas Conservation Act, The Crown Minerals Act, The Pipe Lines Act and respective regulations.

Specifically this branch:

- determines crude oil and natural gas reserves for use by industry and government in planning and developing policies;
- evaluates industry applications for enhanced oil recovery projects, waste water disposal wells, off-target wells and other proposals and participates in public inquiries held to consider these applications;
- assesses unitization proposals to ensure that Crown lands receive fair and equitable unit participation;
- evaluates industry submissions for incremental oil production from waterflood and enhanced oil recovery projects to establish reductions to Crown royalties and freehold production taxes;
- establishes pool boundaries, well spacing and target areas to facilitate orderly oil and natural gas development;
- issues maximum permissive production rates for oil wells and daily allowables for gas wells, and monitors production to ensure that these rates are not exceeded;
- issues construction and operating permits for oil and natural gas pipelines and witnesses pressure tests conducted to ensure that pipelines meet operating standards;
- prepares for publication, pertinent engineering, development and production data for oil and natural gas pools, including monthly demand for Saskatchewan crude oil;
- monitors crude oil markets and tabulates nominations for crude oil; and
- provides technical expertise and assistance to other branches and divisions in the department.

Highlights

The highlight of the year was the increase in drilling activity to record levels which resulted in a proportional increase in the number of applications and submissions that the branch reviewed. The record drilling also required extra effort in activities initiated by the branch such as the review of reserves and pool boundaries.

Another highlight for the branch was the establishment of a Crude Oil Market Analysis Section to deal with issues such as crude oil pricing, transportation and refining.

Crude Oil Reserves

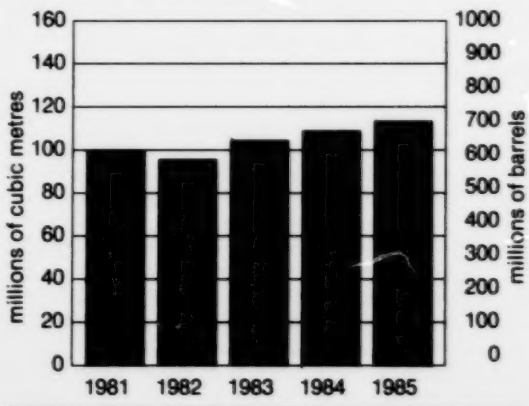
Saskatchewan's remaining established crude oil reserves were increased by 11.462 million cubic metres to 119.237 million cubic metres in 1985. This is the net result of an increase in initial reserves of 23.046 million cubic metres less production of 11.584 cubic metres. This is the third consecutive year in which the annual reserve increases have exceeded production, largely attributed to the record exploratory and development drilling activity.

The department estimates that the potential enhanced oil recovery reserves are 667 million cubic metres with 89 per cent of these reserves classified as heavy oil.

These potential reserves are an indication of the oil that can be recovered assuming that enhanced oil recovery techniques are successfully applied. Considerable technical risk currently exists requiring further research and experimentation.

Shell's Carbon Dioxide Pilot Project near Midale.

Figure 9
Remaining Oil Reserves

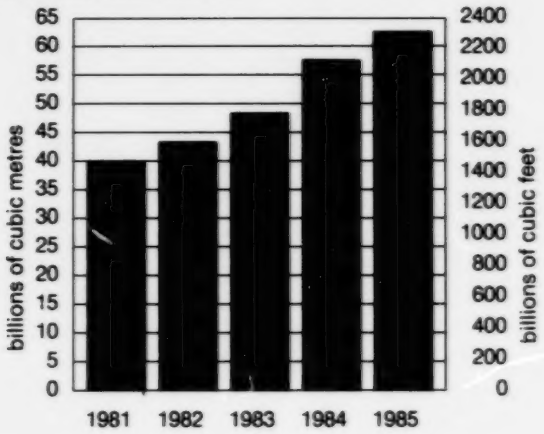


Natural Gas Reserves

Saskatchewan's remaining established natural gas reserves were increased by 5.212 billion cubic metres to 63.451 billion cubic metres in 1985. This is the net result of an increase in initial reserves of 7.172 billion cubic metres less established reserves production of 1.96 billion cubic metres.

The department estimates that the remaining ultimate potential which includes established reserves ranges between 76 and 161 billion cubic metres. Additional exploration and development is required for better evaluation.

Figure 10
Remaining Gas Reserves



Crude Oil Production

Oil production in 1985 was 11.6 million cubic metres compared to 10.8 million cubic metres in the previous year. This 7.4 per cent increase was the result of continued strong markets for Saskatchewan's crude oil and increased drilling activity. On average, there was minimal shut-in of production due to marketing difficulties and pipeline capacity in 1985. However, the months of January and December saw 18 per cent and 9 per cent, respectively, shut-in. Up to 20 per cent of the province's crude was shut-in in March due to pipeline and marketing difficulties in the first quarter of 1986.

Saskatchewan's oil production is made up of different qualities of crude commonly identified as light, medium and heavy found in different geological areas. In 1985, approximately 33.1 per cent was heavy oil, 33.0 per cent was medium and 33.9 per cent was light.

Figure 11
Crude Oil Production

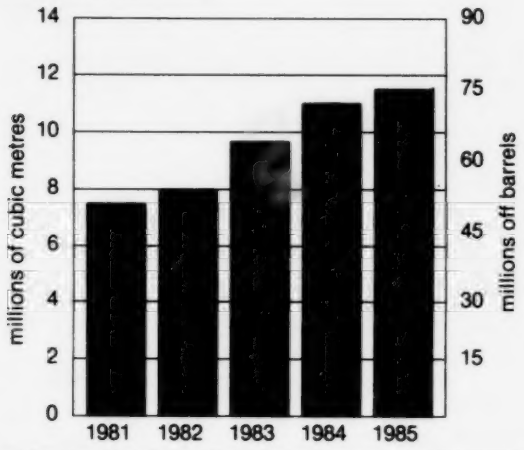
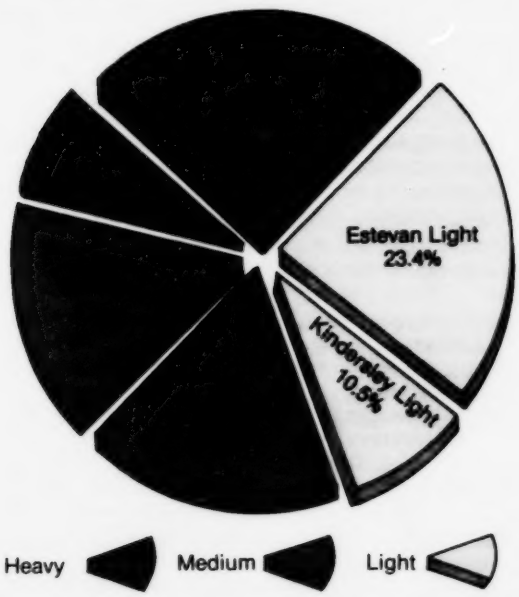
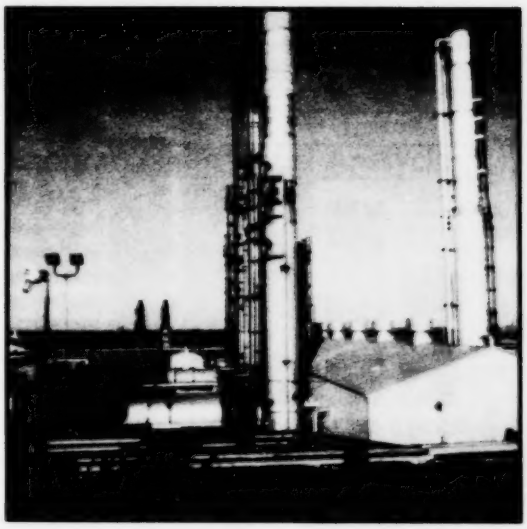


Figure 12
Quality of Saskatchewan Crude Oil Production by Area for Calendar Year 1985



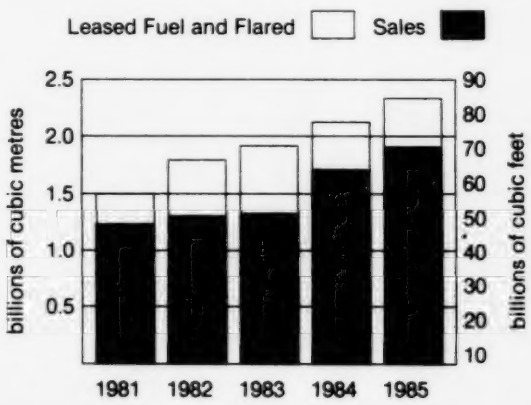
Natural Gas Production

Natural gas production in 1985 was 2.39 billion cubic metres, an increase of 12.2 per cent from the previous year when it was 2.13 billion cubic metres. Sales of natural gas were 1.96 billion cubic metres with the remainder of the production used for lease fuel or flared. These sales represent about 57 per cent of provincial demand with the difference imported from Alberta. Natural gas production will progressively increase because these imports will be reduced as the province strives for self-sufficiency. Import reduction will allow the province's shut-in reserves to be developed and produced. In addition, limited interruptible natural gas exports to eastern Canada which will further increase production commenced in the first quarter of 1986 .



Steelman Gas Plant.

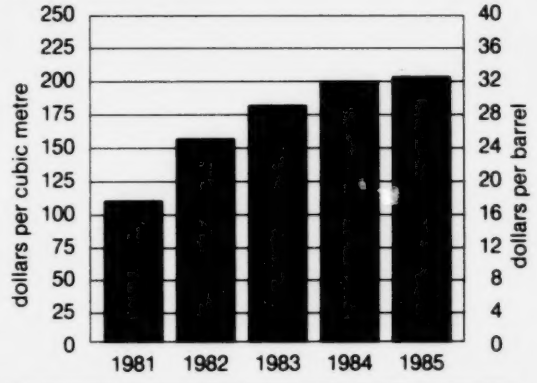
Figure 13
Natural Gas Production



Average Crude Oil Prices

The average 1985 Saskatchewan crude oil price of $208.22 per cubic metre represents an 3.3 per cent increase over the $201.50 per cubic metre average for 1984. Crude oil prices were deregulated on June 1, 1985 which allowed the province's crude prices to track world prices. Crude prices began plummeting in December, 1985 and saw a devastating drop in the first quarter of 1986.

Figure 14
Average Crude Oil Prices



Geology and Petroleum Lands Branch

Geology Mapping and Land Evaluation Section

This section has two principal responsibilities: geological mapping and land evaluation.

Geological Mapping Unit

Geological maps, mainly structure contour maps are drawn and maintained for all oil and gas producing areas in the province. The maps are used for land evaluation, reserve calculations in the Engineering Services Branch, and in helping solve problems related to the producing areas. At the end of the fiscal year, 119 pool maps were being maintained. The maps may be purchased from the department's publications office.

In carrying out their mapping work geologists acquire a detailed knowledge of the geology of the producing oil and gas pools. This expertise is put to use within the Petroleum and Natural Gas Division when staff members are asked to make recommendations on submissions from industry or in dealing with other administrative matters.

Industry submissions in the reporting period included applications for pressure maintenance of producing units, conversion of wells to salt water injection and disposal, and secondary recovery of oil by waterflood. As well, requests were received for permission to drill wells outside the approved spacing pattern and for abnormal well spacing patterns.

Information and advice were made available to other branches, departments and the general public on requests ranging from the interpretation of the economic geology of known oil and gas accumulations to the hydrocarbon potential of unexplored prospects.

Land Evaluation Unit

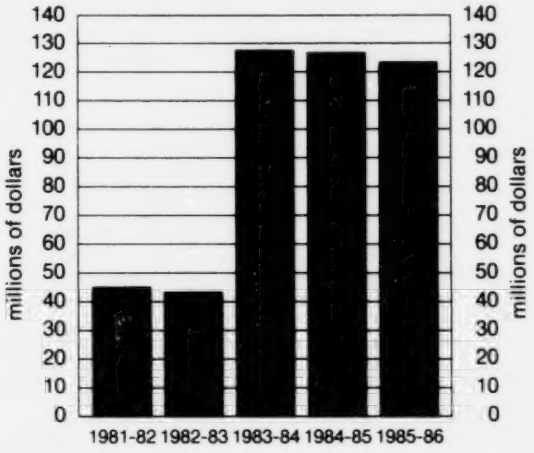
The economic potential of hydrocarbon resources underlying specific areas of the province is determined as required by the department. Monetary evaluations of reserves are primarily for land sales. As well, this unit:

- reviews and recommends requests from industry for the posting of specific Crown mineral lands at department land sales;
- prepares sales notices and technical data for sales;
- reviews and recommends acceptance or rejection of bonus bids received from industry on posted lands;
- evaluates and selects Crown acreage in drilling reservations when such reservations go to lease;
- administers net royalty leases and inspects non-unit net royalty leases and farmouts to ensure compliance with the terms or agreements made within the department;
- reviews requests for waiver of offset well commitments on leases adjoining certain freehold lands producing oil or gas and makes follow-up recommendations; and
- advises industry and the general public concerning the value of mineral rights for specific areas.

Four sales of Crown petroleum and natural gas rights were held during the 1985-86 fiscal year. Revenues totalled $122,778,045.53, down from the $126,842,909.26 realized in the previous fiscal year. The $40.7 million realized at the September 10, 1985 sale was the second highest sale on record. Disposition of mineral rights in the 1985-86 fiscal year totalled 661,010 hectares, (1,633,333 acres), consisting of 56 permits containing 428,568 hectares, (1,058,977 acres), 43 drilling reservations comprising 61,097 hectares, (150,968 acres), and 1,252 leases consisting of 171,344 hectares, (423,385 acres).

Revenue from the sale of petroleum and natural gas rights for the past 5 years is shown in Figure 15.

Figure 15
Revenue from Sales of Crown Petroleum and Natural Gas Rights



Petroleum Lands Section

This section's responsibilities are twofold: disposition administration and registration.

Disposition Administration

This responsibility involves the administration and disposition of approximately 8.8 million acres of Crown mineral lands under The Petroleum and Natural Gas Regulations, 1969; The Helium and Associated Gases Regulations, 1964; The Oil Shale Regulations; The Mineral Resources Act; and The Oil and Gas Conservation Act.

The number of petroleum and natural gas permits under disposition increased from 70 at April, 1985 to 112 at March 31, 1986 with an increase in area from 379,567 hectares, (937,896 acres) to 726,288 hectares, (1,794,633 acres). Drilling reservations under disposition decreased in the same period from 60 to 49 with a decrease in area from 79,229 hectares, (195,773 acres) to 670,070 hectares, (165,728 acres). There were 9,738 petroleum and natural gas leases in effect which represents an increase from 8,621 leases in effect in April, 1985. Area under lease totalled 2,463,751 hectares, (6,087,845 acres).

Lands under helium leases remained at 9 with no change in area at 21,549 hectares, (53,247 acres). One helium permit was in effect for an area of 30,110 hectares, (74,400 acres). Oil shale permits increased from 1 to 4 representing an increase in area from 40,276 hectares, (99,520 acres) to 161,172 hectares, (398,250 acres) with one oil shale lease totalling 1,942 hectares, (4,800 acres) remaining in effect. A total of 11 gas storage agreements covering an area of 39,108 hectares, (96,633 acres) was also in effect.

Registration

This responsibility involves the monitoring, recording and registering of transactions directly affecting all dispositions through transfers, amalgamations, encumbrances or securities. A monthly average of 450 transactions occurred in 1986 which represents an increase from the monthly average of 323 transactions in the previous year. Approximately 5,400 transactions directly affected dispositions to the end of March, 1986. As a supplement to this activity, Petroleum Lands provides a search service. The highest monthly average recorded was 488 searches completed in March, 1985. The monthly average in 1985-86 was 400 searches which represents a total request of approximately 4,800 searches to the end of March, 1986.

Economic and Fiscal Analysis Branch

The Economic and Fiscal Analysis Branch evaluates, designs and implements oil and gas Crown royalty and freehold tax systems and exploration/development incentive systems to maximize provincial revenues while maintaining an active oil and gas industry. In addition, the branch provides production, revenue, expenditure and employment forecasts related to Saskatchewan's oilfield.

Functionally, the branch is divided into the Royalty/Tax Analysis Section and the Incentive Administration Section.

Royalty/Tax Analysis Section

This section analyses, designs and amends the crude oil and gas Crown royalty and freehold tax regimes cited within The Petroleum and Natural Gas Regulations, 1969 and The Freehold Oil and Gas Production Tax Regulations, 1983. The production, revenue and employment forecasts are also prepared by this section.

More specifically, this section:

- evaluates the economics of crude oil and gas exploration, development and production under varying federal and provincial fiscal arrangements;
- analyses, develops and proposes royalty and tax incentives to encourage exploration and development drilling;
- analyses, develops and proposes royalty and tax incentives to encourage implementation of enhanced oil recovery schemes, (e.g. waterfloods, steamfloods, carbon dioxide floods);
- develops the schedules, fact sheets and orders-in-council related to regulation amendments;
- monitors and forecasts crude oil prices, gross oil revenues, provincial revenues, oil production and related oil expenditures and employment;
- analyses the impact of changes, (e.g. prices, federal taxation) that affect oil and gas activity in the province and surrounding jurisdictions;

- provides analytical assistance pertaining to upgrader negotiations and consumer gasoline inquires;
- monitors revenue sharing between governments and industry;
- prepares submissions to boards and commissions on future crude oil supplies and demand;
- prepares information circulars, notices and letters to keep industry informed of changes; and
- performs the necessary consultation process with industry regarding policy changes.

The Economic and Fiscal Analysis Branch participated in the process leading up to the signing of the Western Accord on March 26, 1985. The major features of the accord included the deregulation of crude oil prices effective June 1, 1985, the elimination of the Petroleum and Gas Revenue Tax, (PGRT) on new developments after March 31, 1985, the phase-out of the PGRT on all remaining production by the end of 1988 and the discontinuance of the Petroleum Incentive Program, (PIP) by March 31, 1986. The accord contributed to the province's 1985 record drilling year of 3,848 wells. Changes to certain administrative procedures and amendments to the regulations were developed and put in force during the fiscal year.

In 1985, the branch played a major role in designing a new gas royalty and pricing structure. The structure was announced and put in force in July, 1985 along with all the necessary regulation amendments. The new production-sensitive royalty and higher price will increase revenues to the province and move the province closer to complete self-sufficiency in natural gas production by the early 1990's.

The drop in crude oil prices from approximately $30/bbl (U.S.) to $12/bbl (U.S.) over a span of four months threatened much of Saskatchewan's oil production and many oilfield jobs. Essentially all new development programs were immediately suspended and existing wells were shut-in. The branch initiated an impact analysis of low oil price on provincial oil revenues, activity and employment. The objective of the analysis was to find a means to maintain existing production and jobs in the oilfield during the period of low oil prices.

In July, 1982, the government announced an enhanced oil recovery, (EOR) regime which consisted of pre-payout and post-payout provisions for EOR investment. After a long period of consultation with industry, these cost-sensitive EOR regulations were finalized for introduction in early 1986. Due to the problems facing EOR development in Saskatchewan, the branch proposed several small revisions to the 1982 regime. The changes were incorporated into the regulations.

During the year, the branch prepared a number of economic and financial forecasts for internal and/or external use. The drop in oil prices, Lloydminster upgrader discussions, Interprovincial Pipe Line capacity problems, marketing problems, incentive analysis, and budgeting are some examples in which forecasts of production, revenue and/or employment were required.

Incentive Administration Section

The Incentive Administration Section is responsible for the development, analysis and administration of incentive programs offered by the province to promote increased activity. The section closely monitors the cost effectiveness of these incentive programs to ensure maximum return for the province's incentive dollar as well as a positive atmosphere for development and exploration in the province.

This section reviews all requests related to the administration of the oil royalty/tax holiday program. Under the program, non-deep development wells are eligible for one year holiday. Similarly, the incremental production from new or expanded waterflood projects is eligible for one year holiday. Exploratory and deep wells qualifiy for holiday periods of three to five years. During 1985, approximately 3,000 wells were eligible for the one year holiday while 240 wells were approved as exploratory and a further 20 wells were approved as either deep development or deep exploratory wells.

Economic and technical evaluations are carried out under the Workover Incentive Program. Under this program the department may approve the reclassification of old oil production to new oil for royalty/tax purposes. Approval requires submission of a work program designed to maintain and improve production from old oil wells or units.

A three year phase-out of the Approved Expenditure Grant Program was initiated January 1, 1983. Under the terms of the phase-out, companies can recover all or a portion of the approved expenditure credits that were built up under the old grant program. Responsibilities include forecasting and determining payment requirements, and handling industry inquiries. In the 1985-86 fiscal year $18.3 million was paid out under this program.

The Incentive Administration Section also:

- monitors and forecasts exploration and development expenditures;
- monitors and forecasts operating costs associated with the production of crude oil;
- assists the federal Petroleum Incentives Administration with technical information on related applications;
- conducts economic and engineering analyses on special problems issues, wells and projects;
- provides administration and policy information to assist industry; and
- develops and maintains computer well information programs to enable the duties of this branch and other branches to be more accurately performed.

Following a detailed and extensive review by the branch, the Premier announced on June 12, 1985 an extension of the one year royalty and tax incentive (holiday) period to the end of 1986. This extension was made to allow time for the department to analyse, develop and consult with industry on a new permanent incentive structure which will enable future oil developers to do long term planning. This process has been initiated and continues into the 1986-87 fiscal year.

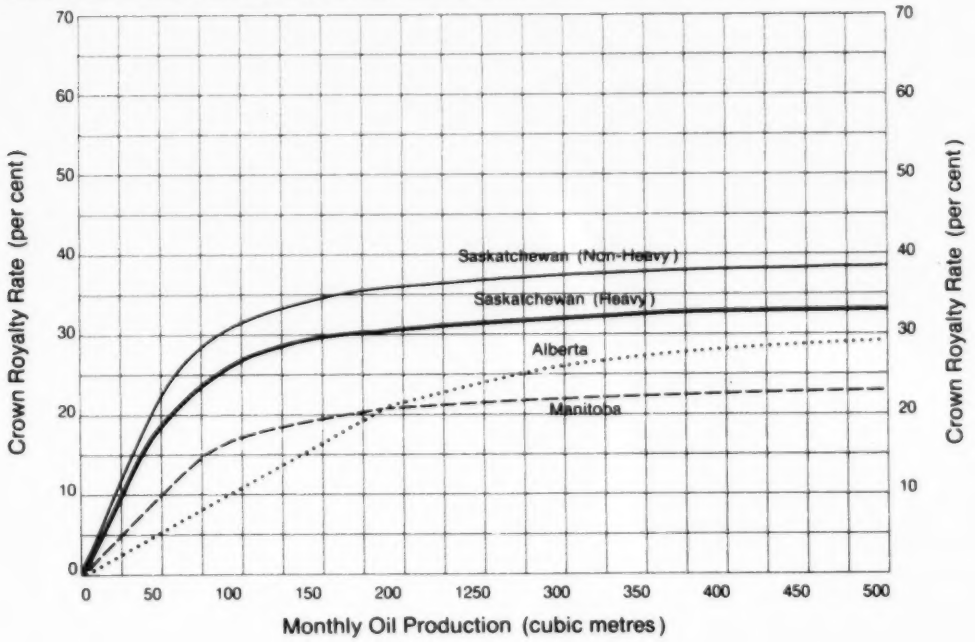
Petroleum Statistics Branch

The Petroleum Statistics Branch is responsible for the collection, processing and management of statistical data on the production and disposition of petroleum resources in the province in accordance with the regulatory requirements of The Oil and Gas Conservation Act and regulations thereunder; the maintenance and efficient operation of computerized data processing and storage systems; the administration of the Production Monitoring/Testing/Auditing Program; the monitoring and evaluation of wellhead oil and gas prices and transportation costs; and the provision of statistical services to both internal and external users.

In particular, the branch:

- collects, validates, processes and records statistical data on the production and disposition of crude oil, natural gas, water and other products associated with oil and gas field operation;
- maintains, develops and implements appropriate modifications and enhancements to existing computer systems as well as designs and develops new systems to meet new policy initiatives;
- participates in a joint review process with other western producing provinces and industry task force committees on the development and standardization of all industry reporting forms, procedures and requirements;
- administers and co-ordinates activities of the Production Monitoring/Testing/Auditing Program to ensure proper and accurate measurement and allocation of production among wells tied to a common producing facility with primary emphasis on wells receiving royalty/tax incentives;
- reviews, establishes and informs industry of the appropriate royalty/tax status and length and commencement date of incentive period of new wells/units as well as maintains and updates the status of existing wells/units;
- monitors, analyses and evaluates posted terminal prices and reported wellhead prices of Saskatchewan crude oil and natural gas and the delivered price of that oil and gas to specific markets;

Figure 16
Conventional Crude Oil Royalty Curves for New Developments March, 1986



- monitors and investigates oil and gas production and disposition reporting practices to ensure compliance and to provide assistance and interpretation to industry with regulatory requirements;
- reviews, analyses and evaluates pipeline tariffs and trucking costs and its economic impact on provincial royalty/tax revenues;
- monitors, researches and compiles statistical information pertaining to the marketing of Saskatchewan crude oil and natural gas production;
- monitors, assesses and establishes the quality of Saskatchewan crude oil production on an individual well, battery and pool basis;
- prepares for publication various weekly, monthly and yearly statistical reports on the production and disposition of petroleum and mineral resources; and
- provides statistical services to petroleum industry, federal and provincial government bodies, consulting firms, universities and the general public.

The branch continued to face an increased workload due to record levels of industry activity. A total of 3,279 wells were brought on production during 1985, increasing the number of active oil, gas and service wells in the province to 20,974 wells for which statistical reports are received monthly.

In 1985, an added responsibility to the branch was the administration and co-ordination of the Production Monitoring/Testing/Auditing program involving activity in several branches in the department. The program was designed to ensure accurate and proper measurement, allocation and reporting of crude oil produced from each and every well in the province. This is particularly important as provincial royalty/tax revenues are based on individual production volumes of each well or a group of wells under unitized operation.

On June 1, 1985 the deregulation of crude oil prices and taxation changes brought on a number of unexpected issues which had a severe impact on reporting procedures and requirements. Various concepts and options were analysed and developed by the branch for discussion with representatives of various industry associations that led to a resolution that is mutually beneficial.

Concurrent with oil price deregulation is the termination of the New Oil Reference Price, (NORP), Special Old Oil Price, (SOOP) and Crude Oil Export Charge Revenue Sharing programs which were established under the National Energy Program. The NORP and SOOP programs were funded by the federal government to provide world pricing to eligible oil production in the province. Cumulative supplemental revenue to both oil producers and the province under these two programs since their inception in 1982 amounted to over $710 million. The Crude Oil Export Charge Revenue Sharing program enabled each producing province to receive 50 per cent of the revenues from export charges accruing to crude oil produced in that province which is subsequently exported. Cumulative revenue received by the province since November 1, 1980 amounted to more than $555 million.

Toward fiscal year end, discussions on oil and gas industry reporting were underway between the western producing provinces of Alberta, British Columbia and Saskatchewan and Industry Task Force Committee consisting of representatives from the Canadian Petroleum Association, Independent Petroleum Association of Canada and the Canadian Association of Petroleum Production Accounting. The focus of these discussions is the development of standardized reporting formats, procedures and requirements and the feasibility of reducing the volume of paper flow. Discussions are continuing with significant progress expected.